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REMEDIAL ACTION QUALITY ASSURANCE PROJECT PLAN

SKINNER LANDFILL SITE BUTLER COUNTY WEST CHESTER, OHIO

Prepared for:

Skinner Landfill Work Group
c/o Ben Baker
2020 Dow Center
Midland, MI 48764

Prepared by:

Earth Tech, Inc.
200 Vine Street
Wilder, KY 41076

FINAL
February 2001

Project Number 38335

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LIST OF ACRONYMS

AMP	Air Monitoring Plan
AOC	Administrative Order on Consent
BCDES	Butler County Department of Environmental Services
BOD	Biochemical Oxygen Demand
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
Conrail	Consolidated Railroad Corporation
CQAP	Construction Quality Assurance Plan
CRL	Central Regional Laboratory
DNAPLs	Dense Non-Aqueous Phase Liquids
DQOs	Data Quality Objectives
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
GCAL	Gulf Coast Analytical Laboratories
HASP	Health and Safety Plan
ID	Inner Diameter
LTPP	Long-Term Performance Plan
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSL	Mean Sea Level
NCP	National Contingency Plan
NITS	National Institute of Testing and Standards
OEPA	Ohio Environmental Protection Agency
PCBs	Polychlorinated Biphenyls
PAHs	Polynuclear Aromatic Hydrocarbons
PPE	Personal Protective Equipment
PRP	Potentially Responsible Party
QA	Quality Assurance
QAO	Quality Assurance Objectives
QAPP	Quality Assurance Project Plan (Laboratory)
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SLWG	Skinner Landfill Work Group
SU	Standard Units
SOP	Standard Operating Procedure
SOW	Statement of Work

LIST OF ACRONYMS - CONT

SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

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Distribution List

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1.0 PROJECT DESCRIPTION

The United States Environmental Protection Agency (U.S. EPA) requires that all environmental monitoring and measurement efforts mandated or supported by U.S. EPA participate in a centrally managed quality assurance (QA) program.

Any party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPjP) covering each project it is to perform.

This QAPjP presents the organization, objectives, functional activities and specific QA and the quality control (QC) activities associated with implementing the Remedial Design (RD) at the Skinner Landfill Site. This QAPjP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain-of-custody, and field and laboratory analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, U.S. EPA requirements, government regulation and guidelines, and specific project goals and requirements. The laboratory to be used during this project is Gulf Coast Analytical Laboratories (GCAL). GCAL has prepared a Comprehensive Quality Assurance Project Plan (QAPP) dated September, 1998 which documents how compliance with these requirements will be achieved. In the event another laboratory is selected to replace GCAL during the RA, applicable sections of the replacement laboratory's QAPP will be attached to this RD QAPjP, pending approval by the U.S. EPA. A laboratory has not yet been selected for conducting the analysis on the effluent samples. When the effluent laboratory has been selected, applicable sections of the laboratory's QAPP will be attached to this RD QAPjP, pending approval by the U.S. EPA.

This RD QAPjP was prepared by Earth Tech on behalf of the Skinner Landfill Work Group in accordance with all U.S. EPA QAPjP guidance documents including the Contract Laboratory Program (CLP) guidelines, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005/80), and the U.S. EPA Region V Model QAPjP (1991) and Model Mini-QAPjP (1993).

1.1 Site Location and Description

The Skinner Landfill is located approximately 15 miles north of Cincinnati, Ohio near West Chester, Butler County, Ohio in Township 3, Section 22, Range 2. The site is located along Cincinnati-Dayton Road as shown in Figure 1.

The site is bordered on the south by the East Fork of Mill Creek, on the north by wooded land, on the east by a Consolidated Railroad Corporation (Conrail) railroad right-of-way, and on the west by Skinner Creek.

The site is located in a highly dissected area that slopes from a till-mantled bedrock upland to a broad, flat-bottomed valley that is occupied by the main branch of Mill Creek. Elevations on the site range from a high of nearly 800 feet above mean sea level (MSL) in the northeast, to a low of 645 feet above MSL near the confluence of Skinner Creek and East Fork of Mill Creek. Both Skinner Creek and the East Fork of Mill Creek are small, shallow streams. Both of these streams flow to the southwest from the site toward the main branch of Mill Creek. A third on-site stream, Dump Creek, borders the former landfill on the east. Dump Creek is intermittent and flows south into the East Fork of Mill Creek. Three shallow ponds are also located on the site.

In general, the site is underlain by relatively thin glacial drift over interbedded shales and limestones of Ordovician age. The composition of the glacial drift ranges from intermixed silt, sand and gravel, to silty sandy clays; and its thickness ranges from zero to over 40 ft at the site. The sand and gravel deposits comprise the hills and ridges and are encountered near the surface of the central portion of the site. The silts and clays usually occur as lenses in the sands and gravel or directly overlie bedrock.

1.2 Site History and Background

The property was originally developed as a sand and gravel mining operation, and was subsequently used as a landfill from 1934 to 1990. According to U.S. EPA studies, materials deposited at the site include demolition debris, household refuse and a wide variety of chemical wastes. The waste disposal areas include a now buried waste lagoon near the center of the site and a landfill. According to U.S. EPA studies, the buried lagoon was used for the disposal of paint wastes, ink wastes, creosote, pesticides, and other chemical wastes. The landfill area, located north and northeast of the buried lagoon, received predominantly demolition and landscaping debris.

In 1976, the Ohio EPA (OEPA) initiated an investigation of the site in response to reports of a black oily liquid that was observed during a fire call to the site. Before the OEPA could complete the investigation, the landfill owners, the Skinners, covered the lagoon with a layer of demolition debris. Mr. Skinner further dissuaded the OEPA from accessing the site by claiming that nerve gas, mustard gas, and explosives were buried in the landfill. The OEPA requested the assistance of the U.S. Army after obtaining this information. Mr. Skinner later retracted his statements concerning buried ordnance, and an U.S. Army records review performed in 1992 did not reveal any evidence of munitions disposal at the site.

In 1982, the site was placed on the National Priority List by the U.S. EPA based on information obtained during a limited investigation of the site. The investigation indicated groundwater contamination had occurred as a result of the buried wastes. In 1986, a Phase I Remedial Investigation was conducted that included sampling of groundwater, surface water, and soil, as well as a biological survey of the East Fork of Mill Creek and Skinner Creek. A Phase II Remedial Investigation was conducted from 1989 to 1991 and involved further investigation of groundwater, surface water, soils and sediments. A Baseline Risk Assessment and Feasibility Study (FS) were completed in 1992.

The Phase II Remedial Investigation revealed that the most contaminated media at the site is the soil from the buried waste lagoon. Lower levels of contamination were also found in soils on other portions of the site and in the groundwater, and very low levels were found in the sediments of Mill Creek, Skinner Creek, the Duck Pond and the Diving Pond. Migration of the landfill constituents has been limited, and the Phase II Remedial Investigation concluded that there had been no off-site migration of landfill constituents via groundwater flow.

The Record of Decision (ROD) was developed based on the Phase I and II Remedial Investigation findings and was signed on June 4, 1993. In the ROD, U.S. EPA selected a remedy for the site consisting of multi-media capping of the landfill and the buried waste lagoon, and interception and treatment of the contaminated groundwater. The ROD also required an investigation to determine the feasibility for soil vapor extraction (SVE) in the granular soil adjacent to the buried lagoon.

A RD Pre-design field investigation was performed in 1994 and 1995 to collect data required to assess the feasibility of the SVE and to design the multi-media cap and the groundwater extraction/treatment systems.

Based on the results of the pre-design field investigation, necessary data was collected to design the U.S. EPA selected remedies. The following results were developed based on the pre-design investigation:

- Groundwater analysis conducted during previous investigations and the Pre-design RD field investigation indicated groundwater has been impacted at the Skinner Landfill Site and the current groundwater conditions are similar to those used to develop the ROD;
- Trigger levels used in the Administrative Order to define groundwater contamination were modified based on the methods described in the Statement of Work (SOW);
- A combination of collection trenches and cut-off wall were proposed as the downgradient groundwater control system;
- Effluent discharge standards for the treated groundwater were proposed;
- The extent of contaminated soil from three isolated areas and the Northeastern Corner was defined. Contaminated soil was only identified at two of the isolated areas (at BP01/BP02 and around GW-38) and was not identified in the Northeastern Corner;
- The limits of landfill waste were defined; and
- The SVE system for the removal of organic vapors within the permeable materials adjacent to portions of the buried waste lagoon was determined not to be feasible.

1.3 Project Objectives and Scope

This QAPjP is part of the RD for the Skinner Landfill. The RD QAPjP has been prepared pursuant to the requirements of the SOW of the Administrative Order on Consent (AOC) between the U.S. EPA and the Skinner Landfill Group dated June 4, 1993. The QAPjP is an integral part of the RD and defines the site-specific QA methods and controls that will be used to collect and analyze samples during the implementation of the RA. The RD QAPjP is designed to ensure that the quality, precision, accuracy, and completeness of the data generated meets the established data quality objectives (DQOs).

The selected RA components at the Skinner Landfill include the following:

- Institutional Controls;
- Engineered Landfill Cap (including excavation and consolidation of contaminated soils underneath the cap);
- Groundwater Interception and Treatment Systems;
- Air Compliance Monitoring (during construction of the Landfill Cap and Groundwater Interception and Treatment Systems);
- Groundwater Compliance Monitoring; and

- Surface Water Monitoring.

Sampling and chemical analysis of soils, groundwater, effluent and surface water will occur as part of this project during the implementation of the RA. Testing of samples related to the design and construction of the site remedy will also be conducted. A description of these and other field activities are included in the RD Field Sampling Plan (FSP) and in the Long-Term Performance Plan (LTPP), RD Air Monitoring Plan (AMP), RD Health and Safety Plan (HASP), RD Construction Quality Assurance Plan (CQAP), and in the applicable RD sections. An overview of the RA sampling and chemical analysis programs is presented in Table 1.

1.4 Sample Network Design and Rationale

The RD FSP includes site-specific sampling plans, sampling procedures and methodologies, site maps and details of the level of effort to be used during the implementation of the RA at the Skinner Landfill. A description of the sampling activities is summarized below. The QAPjP will be updated with respect to biological sampling (macroinvertebrate, fish sampling and bioassay) when the exact list of parameters to be analyzed and the frequency of sample collection has been established by BCDES. Locations of all field sampling activities are shown in Drawings 1, 2 and 3 of the FSP.

1.4.1 Contaminated Soil Design Investigation

Soil contamination at the Skinner Landfill (outside the limits of the landfill cap) will be excavated and incorporated under the multi-media cap. The aerial extent of this contaminated soil was defined in the RD Pre-design Report Contaminated Soils Design Investigation, June 1, 1995 based on data collected during the Phase II Remedial Investigation and the RD Pre-design Investigation. Per the RD Pre-design Report, soil contamination above the SOW trigger levels were identified at two areas (BP01/BP02 and around Well GW-38).

Buried Pit Area (BP01/BP02): Polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and lead have been identified in the vicinity of BP01/BP02. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and lead were identified at concentrations exceeding the U.S. EPA specified remedial trigger levels (see Table 3).

The areal extent of contamination is defined in Figure 2, with contamination estimated to extend to a depth of 7.5 feet below ground surface. Excavation of the contaminated soil will be conducted during the RA until clean soil (below the remedial trigger levels) is confirmed through the chemical analysis of the underlying unexcavated material. Each RA soil sample will be collected for analysis of the parameters listed in Table 3 of this RD QAPjP.

Well GW-38 Area: PAHs have been identified in the vicinity of GW-38 during previous field investigations. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and chrysene were identified at concentrations exceeding the remedial trigger levels (see Table 3).

The areal extent of contamination around GW-38 is defined in Figure 3 with contamination estimated to extend to a depth of 7.5 feet below ground surface. Excavation of the contaminated soil will be conducted during the RA until clean soil (below the remedial trigger levels) is confirmed through the chemical analysis of the underlying unexcavated material. Each RA soil sample will be collected for analysis of the parameters listed in Table 3 of this RD QAPjP.

During the remedial action if drums are discovered, the excavation will cease and the field team leader will be notified. The field team leader with the help of a chemist will determine if the drum can be relocated to an area marked off for the staging of drums for offsite treatment/disposal. Like samples will be composited and shipped to the laboratory for analysis.

1.4.2 RA Surface Water Monitoring

During the RA, contaminated soil excavation activities of the RA at BP01/BP02 and around GW-38 may have an impact on the surface water quality of the East Fork of Mill Creek and Skinner Creek. To monitor the potential impacts, the East Fork of Mill Creek and Skinner Creek will be evaluated during the RA by collecting/analyzing surface water samples from five sample locations during each sampling event (see FSP Drawing 3 for location of SW-50, SW-51, SW-52, SW-53 and SW-54). The RA results will be compared to the data collected during the baseline surface water study conducted during the RD Pre-design Investigation. Each surface water sample will be collected and analyzed for the parameters listed in Tables 4 and 5 of this QAPjP. Surface water sampling events will be conducted monthly until the completion of the excavation activities.

Surface water run-off associated with the installation of the groundwater interception/treatment system and the landfill cap may have an impact on the surface water quality of the East Fork of Mill Creek. The potential impacts to the East Fork of Mill Creek will be evaluated during the RA by collecting/analyzing surface water samples from three sample locations during each sampling event (see FSP Drawing 3 for locations of SWD-1, SWD-2 and SWD-3). The RA results will be compared to the data collected during the baseline surface water study conducted during the RD Pre-design Investigation. Each surface water run-off sample will be collected and analyzed for the parameters listed in Tables 4, 5, and 7 of this QAPjP. Run-off sampling events will be conducted monthly until the completion of the RA construction activities (but only after a rain event).

Finally, the long-term effectiveness of the U.S. EPA-approved remedy in protecting the surface water quality of the East Fork of Mill Creek will be evaluated. To monitor the water quality, surface water samples will be collected and analyzed from four sample locations (see LTPP Drawing 2 for locations of SW-50, SW-51, SW-52 and SW-53) and the results compared to the data collected during the baseline surface water study conducted during the RD Pre-design Investigation. Each surface water sample will be collected and analyzed for the parameters listed in Tables 4, 5, and 7 of this QAPjP.

In the event the monthly surface water sampling coincides with the surface water sampling associated with the contaminated soil excavation activities, sample redundancy will be eliminated and only one sample will be collected from each of the applicable sample locations.

1.4.3 RA Groundwater Monitoring

Per Section II of the SOW, a downgradient groundwater control system is required at the Skinner Landfill Site. This control system is designed to intercept and capture groundwater migrating from the landfill to the East Fork of Mill Creek. The general requirements and site location of the Interception system are defined in Section 2.0 of the Design Report.

The purpose of the groundwater monitoring program found in the FSP and LTPP is to evaluate the long-term performance of the Groundwater Interception System (interception trench and cut-off wall), the cap and the possible presence and/or movement of dense non-aqueous phase liquids (DNAPLs) in the vicinity of the buried waste lagoon.

The groundwater monitoring program will include: 1) installing groundwater monitoring wells downgradient of the buried waste lagoon and downgradient of the cut-off wall, 2) installing piezometers upgradient of the groundwater interception system, 3) measuring groundwater levels upgradient/within the interception trench, groundwater levels downgradient of the cut-off wall, and surface water levels in the East Fork of Mill Creek, 4) monitoring for DNAPLs downgradient of the waste lagoon and 5) collecting and analyzing groundwater samples from monitoring wells downgradient of the groundwater interception system.

1.4.4 RA Interception and Treatment Systems Shut-down

As stated in the SOW, a petition may be filed to terminate operation of the groundwater interception and treatment systems when groundwater in the interception trench and groundwater downgradient of the cut-off wall contain concentrations of contaminants less than those listed in Table 2 of this QAPJP. To meet this condition, groundwater samples from the interception system may be periodically collected and analyzed for the parameters listed in Table 2. The results of these analyses will be compared to the results from the quarterly groundwater performance monitoring. In the event groundwater within the trench and downgradient of the cut-off wall are less than the Table 2 trigger levels (after 4 quarterly sampling events), a petition may be filed with the U.S. EPA to cease operation of the groundwater interception and treatment systems.

1.4.5 Effluent Monitoring

A request has been submitted for authorization to the Butler County Department of Environmental Services (BCDES) to discharge the collected groundwater to a sanitary sewer located on the site. This application is pending. It is anticipated that BCDES will include a requirement to periodically sample the discharge and analyze for certain constituents. However, the exact list of parameters to be analyzed and the frequency of sample collection has not yet been established by BCDES. When the parameters are established, they will be incorporated into this QAPJP as Table 9. The appropriate analytical methods will be identified in Appendix V. The authorization to discharge itself will be added as Appendix III.

1.4.6 Air Monitoring

Personnel and perimeter air monitoring will be conducted during the excavation of the contaminated soils, the construction of the RA cap, and the installation of the interception and treatment systems. The intent of the air monitoring is to determine the effectiveness of on-site controls to prevent airborne contaminant migration and to determine the level of Personal Protective Equipment (PPE) to be worn by the RA personnel. Procedures for this monitoring are found in the RD AMP.

1.5 Data Quality Objectives

The QAPP describes the data that are needed to meet the objectives of the project, how that data will be used, and the implementation of control mechanisms and standards that will be used to obtain data of sufficient quality to meet or exceed all project objectives. The data quality objectives (DQOs) follow the guidance contained in the EPA document, "*Data Quality Objectives Process for Superfund*," Interim Final Guidance, EPA 540-R-93-071. The section in the QAPP on DQOs addresses the following topics:

1. **Statement of the Problem:** The problem that requires environmental data acquisition will be summarized and the resources available to resolve the problem will be identified.

2. **Identification of Decisions:** The decision that requires acquisition of environmental data to address the problem will be identified. The intended uses of data projected to be acquired will be identified. Data uses will be prioritized.
3. **Identify Inputs to Decisions:** The information needed to support the decision will be identified and the inputs requiring environmental measurements will be specified.
4. **Definition of Study Boundaries:** The spatial and temporal aspects of the environmental media that the data must represent to support the decision will be specified.
5. **Development of Decision Rules:** A logical statement that defines the conditions that would cause the decision maker to choose among alternative actions will be developed.
6. **Specification of Limits on Decision Errors:** The decision maker's acceptable limits on decision errors which are used to establish appropriate performance goals for limiting uncertainty in environmental data will be specified.
7. **Optimization of Investigation Design for Obtaining Data:** The most resource-effective sampling and analysis design for generating data that are expected to satisfy project DQOs will be identified.

Statements of the problem are defined quantitatively, if possible. Identification of decisions and descriptions of data use are described with text and supported with tables and lists that describe the following:

- The data needed, including measurement parameters, compounds, and sample matrices.
- The action levels or standards upon which the decisions will be made, including the detection limits and data reporting units for relevant parameters.
- The summary statistic(s) (e.g., mean, maximum, range, etc.), which specify the form the data will be in when compared against action levels or standards.
- The acceptable level of confidence in the data needed for the stated purposes or the acceptable range of uncertainty.

The specifications of limits on decision errors are described quantitatively, wherever possible, for all categories of environmental data. Specifications for data quality describe exactly how such quality will be measured and interpreted.

The overall quality assurance objective (QAO) for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and data reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain of custody, field and laboratory instrument calibration, field and laboratory analysis, reporting of data, internal QC audits, preventive maintenance of field and laboratory equipment, and corrective actions are described in the QAPP.

To achieve data that are consistent with the objectives of the project, there must be an assessment of the performance of five data quality parameters. These data quality parameters are precision, accuracy, representativeness, completeness, and comparability (PARCC).

The quality of measurements made and data acquired will be determined by the PARCC characteristics. Specific objectives for each characteristic are established based on site conditions, objectives of each task, and knowledge of available measurement systems. The subsequent use of these measurements in calculations and evaluations is also subject to the guidelines set by the QAPP.

Data quality protocols will include the criteria specified by referenced analytical methods. The data quality protocols may include, but not be limited to: method detection limits (MDLs), analytical data quality requirements (QC acceptance criteria), data quality assessments and subsequent qualifiers, and required analytical documentation.

Subsequent to data review, any data points deemed to be unusable will be evaluated to determine their importance in meeting the project goals. The RA Project Coordinator and the QA Officer will discuss the unusable data points with the USEPA to determine if resampling is required. If the corrective actions provided for in this document are insufficient, the QA Officer will be contacted for resolution of the problem.

1.5.1 Intended Data Usage

The data generated for this project may be compared with regulatory objectives for environmental and public health protection. The data may be used by Earth Tech to verify environmental compliance with all environmental regulations.

The goal of the DQO Process is to collect data of appropriate quality for environmental decisions, while minimizing expenditures related to data collection by eliminating unnecessary duplication or unnecessarily detailed data. This is accomplished by establishing an organized plan that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application.

The three general categories of DQOs are defined as (1) screening data, (2) screening data plus confirmational definitive data, and (3) definitive data. All project data shall meet one of these categories.

Screening data includes data produced by rapid field screening methods that are less precise than standard analytical methods. Screening level methods produce analyte or class of analyte identification, often at elevated detection levels.

Field screening methods may be confirmed by analysis using definitive methods and accompanying QA/QC procedures. Confirmation samples shall be selected to include both detected and nondetected results from the screening method.

Definitive data are produced using standard EPA or other reference methods, usually in an off-site laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements, providing the information to verify all results. Definitive data are not restricted in their use unless quality problems require data qualification.

The DQOs for sampling and analysis activities are provided in the FSP. Laboratory DQOs are provided in the Laboratory SOPs in the QAPP and are updated regularly to reflect current conditions. Therefore, the laboratory DQOs may be revised as laboratory conditions warrant adjustment.

The DQOs for field measurements (temperature, pH, conductivity, dissolved oxygen and turbidity) at the site will be screening data appropriate for real-time field measurements. The DQOs for samples collected at Skinner Landfill and analyzed by USEPA methodology will produce definitive data, appropriate for non-CLP analysis. The DQOs for samples collected at the site and analyzed for CLP parameters will produce definitive data, using the full CLP protocols.

2.0 PROJECT ORGANIZATION

The project organization for RA activities is presented below. A project organization chart for the RA at the Skinner Landfill Site is presented in Figure 4.

2.1 Agency Participants

U.S. EPA Remedial Project Manager – Scott K. Hansen has responsibility for overseeing implementation of the RA for U.S. EPA. He is the primary point of contact and communication for the agency.

U.S. EPA Region V QA Officer - The U.S. EPA QA Officer has responsibility for reviewing and approving this RD QAPjP, and is available to the U.S. EPA Remedial Project Manager (RPM) as needed for consultation on QA issues.

Ohio EPA Site Coordinator – Charles C. Mellon, has responsibility for representing the interests of OEPA with respect to the RA activities at the Skinner Landfill Site. He is available to the U.S. EPA RPM as needed for consultation on technical and policy issues.

2.2 Implementor Participants

RA Project Coordinator - The Group implementing the remedy has designated Ben F. Baker as the RA Project Coordinator. As such, he has responsibility for overseeing implementation of the AOC for the Group. He will be the primary point of contact for the Group for approving or modifying the scope of work.

Implementor's QA Officer - The Group implementing the remedy has designated Mark Kromis as the QA Officer. He will be responsible for overseeing audits of field and laboratory work and for performing independent validation of the data received from the analytical laboratories.

Field Team Leader – Earth Tech has designated Pat Higgins as the Field Team Leader for the Group. He will be responsible for implementing the day-to-day sampling activities for the RA at the Skinner Landfill.

Site Geologist – Mr. Higgins will also serve as the site Geologist. The Site Geologist is primarily responsible for the proper well purging techniques. The Geologist will be responsible for purging of wells, performing necessary physical measurements and observations, and containment of purged water. He must record pertinent information including amount of water purged, pH, specific conductivity, temperature, and turbidity in the Field Log Book.

Sampling Team - The sampling team to be utilized to implement the RA field sampling activities will be designated by Earth Tech. Jenny Downard and Aaron Benson have been assigned to the Sampling Team. The technical team will gather and analyze data, and prepare various reports. All of the designated technical staff members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.3 RA Construction Company

The selected RA Construction Company (Earth Tech) will be responsible for implementing the RD. Earth Tech will also be responsible for coordinating its construction activities with the sampling activities. Rick Warwick will serve as the Construction Company's Project Manager.

2.4 Laboratory Staff

Gulf Coast Analytical Laboratories (GCAL), located at 7979 GSRI Avenue, Baton Rouge, LA 70820 (225-769-4900), the present lab contractor, will perform laboratory analytical services. Descriptions of the organization, responsibilities, capabilities, and individual duties of the personnel at the laboratory are presented in the section titled "Administrative Organization" of GCAL Comprehensive QAPP (see Appendix I). Valerie Mathurne will serve as GCAL's Project Manager for this work and will be the prime point of contact at the laboratory. Robyn Migues serves as GCAL's Quality Assurance Officer.

A laboratory has not yet been selected for conducting the analysis on the effluent samples. When the effluent laboratory has been selected, applicable sections of the laboratory's QAPP will be attached to this RD QAPjP, pending approval by the U.S. EPA.

2.5 Specific Responsibilities

Day-to-day soil, groundwater, air, effluent and surface water sampling activities to be implemented during the RA could be performed and directed by experienced staff.

Evidence audits of QAPjP field records could be performed by the Implementor's QA Officer and/or the Field Team Leader.

External field and laboratory audits may be performed by the Implementor's QA Officer.

External performance and system audits of the Laboratory's may be performed by Region V Central Regional Laboratory personnel.

3.0 QUALITY ASSURANCE OBJECTIVES FOR ANALYTICAL DATA

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment and corrective action are described in other sections of the QAPjP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness and comparability.

3.1 Level of Quality Control Effort

Field blank, trip blank, duplicate, matrix spike and matrix spike duplicate samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field blanks will consist of deionized water placed in sample containers at the site using the same (decontaminated) equipment that will be used to collect the samples. Field blanks are used to check for contamination which may have been introduced as a result of the sampling procedures and/or from ambient field conditions. Field blanks for aqueous samples be

collected at the rate of at least one per 10 investigative samples (i.e., 10%). Field blanks will not be collected for soil samples.

Trip blanks will consist of deionized water placed in sample containers in the laboratory. These samples will accompany the other (empty) sample containers to the site, be kept with them in the field and accompany the field samples back to the laboratory. Trip blanks are used to assess the potential for volatile organic compound (VOC) contamination of samples due to contaminant migration during shipment and storage. One trip blank will accompany each shipment of VOC samples.

Field duplicate for groundwater samples will consist of sequentially collected samples obtained from the same sampling point. Field duplicate soil or sediment samples will be thoroughly homogenized prior to being split. They are analyzed to check for sampling and analytical reproducibility. Duplicate samples will be collected at the rate of one per 10 investigative samples (i.e., 10%).

Matrix spike samples (which are prepared in the laboratory from extra investigative sample volume collected in the field) provide information about the effect of the sample matrix on the preparation and analytical measurement methodology. The extra volumes required for aqueous samples are triple the normal volume for VOC analysis and double the normal volume for other organic analyses. These extra volumes are in addition to the normal volume requirements for the investigative sample.

All matrix spikes for organic analyses are performed in duplicate and are hereafter referred to as MS/MSD samples. MS/MSD samples will be collected (for organic analysis) at the rate of one per 20 investigative samples (i.e., 5%). A matrix spike and laboratory duplicate for inorganics will be analyzed at the rate of one each per 20 investigative samples (i.e., 5%). The extra volume required for aqueous samples is double the normal volume for inorganic samples. This extra volume is in addition to the normal volume requirements for the investigative sample. MS/MSD and MS/laboratory duplicate samples do not require additional sample volume for soil/sediment samples.

The level of QC effort for chemical measurements made in the field is specified in the SOPs for field measurement of temperature, pH, conductivity, dissolved oxygen, and turbidity. The SOPs are contained in Appendix II of this QAPJP.

The number of investigative and QA/QC samples to be collected during the implementation of the RA is shown in Table 1. The specific parameter lists for each sample are described in Tables 4 to 7. Samples collected during this project will be sent to GCAL for the following analyses: 1) CLP SOW OLM04.2 (or most current SOW) for the analysis of organics and CLP SOW ILM04.0 (or most current SOW) for the analysis of the inorganics. The methods listed in 40CFR136 will be used by the laboratory to be selected to conduct the effluent analyses when BCDES issues discharge criteria. The level of laboratory QC effort to be used for this project will be consistent with the requirements of the CLP SOWs and the laboratory's SOP/methods for parameters identified in the Tables 4 to 7.

3.2 Accuracy and Precision of Analysis

The fundamental QA objective with respect to accuracy and precision of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

The accuracy and precision requirements for analytical work for this project will be those specified in the CLP SOWs (i.e., OLM03.2 for organics and ILM04.0 for inorganics) and the methods specified in Appendices IV, and V for the analysis of the parameter listed in the Tables. The accuracy, precision and

sensitivity segments for chemical measurements made in the field are specified in the SOP's contained in Appendix II.

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed and similar conditions.

Precision of the measurement data for this project will be based upon duplicate analyses (replicability), control sample analyses (repeatability), and results for duplicate field samples (sample replicability). A field duplicate is defined as a sample that is divided into two equal parts for the purpose of analysis. Field duplicates will be collected for all sample matrices and analyzed for all parameters. Discretely sampled field duplicates are useful in determining sampling variability. However, greater than expected differences between duplicates may occur because of variability in the sample material.

Field duplicates shall be used as a quality control measure to monitor precision relative to sample collection activities.

Analytical precision shall be evaluated by using matrix spike/matrix spike duplicates (MS/MSD), laboratory control samples (LCS), or sample duplicates. Precision is calculated in terms of Relative Percent Difference (RPD).

RPDs must be compared to the laboratory-established RPD for the analysis. Precision of duplicates may depend on sample homogeneity. The analyst or his supervisor must investigate the cause of data outside stated acceptance limits. Corrective action may include recalibration, reanalysis of QC samples, sample reanalysis, or flagging the data as suspect if problems cannot be resolved.

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value. Accuracy is a measure of bias in the system.

Accuracy of the measurement data will be assessed and controlled as follows. Results for blanks, matrix, laboratory control, and surrogate spikes will be the primary indicators of accuracy. These results will be used to control accuracy within acceptable limits by requiring that they meet specific criteria. As spiked samples are analyzed, spike recoveries will be calculated and compared to pre-established acceptance limits.

Acceptance limits will be based upon previously established laboratory capabilities for similar samples using control chart techniques. In this approach, the control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established limits indicate some assignable cause, other than normal measurement error, and the need for corrective action.

This includes recalibration of the instrument, reanalysis of the QC sample, reanalysis of the samples in the batch, or flagging the data as suspect if the problem cannot be resolved. Recovery of matrix spikes may depend on sample homogeneity.

3.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratories will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested using CLP SOWs (i.e., OLM03.2 for organics and ILM04.0 for inorganics) and Table 9 for the effluent parameters (when issued by BCDES). The calculation of completeness is described in Section 12.0 below. The field data will also be checked for completeness by comparing the amount of usable data as compared to the total amount of usable data expected.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocols. The sampling network was selected to provide data representative of site conditions based on previous studies conducted at the site. Representativeness will be satisfied by ensuring proper sampling techniques are used, proper analytical procedures are followed, and holding times of samples are not exceeded. Representativeness will also be assessed by the analysis of field duplicate samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. Analytical results are comparable to results of other laboratories with the use of the following procedures/programs: instrument standards traceable to National Institute of Testing and Standards (NITS) or U.S. EPA sources; the use of standard methodology; reporting results from similar matrices in consistent units; applying appropriate levels of quality control within the context of the laboratories quality assurance program; and participation in inter-laboratory studies to document laboratories performance. By using traceable standards and standard methods, the analytical results can be compared to other laboratories operating similarly. The QA Program documents internal performance, and the inter-laboratory studies document performance compared to other laboratories. Periodic laboratory proficiency studies are instituted as a means of monitoring intra-laboratory performance. The procedures used to obtain the planned analytical data, as documented in this QAPjP, are expected to provide comparable data.

4.0 SAMPLING PROCEDURES

Detailed descriptions of the sampling procedures to be used during the RA are described in the RA FSP, RA AMP, RA HASP, RA CQAP, and RA LTPP.

5.0 SAMPLE CUSTODY

It is U.S. EPA and Region V policy to follow the "Policies and Procedures", EPA-330/9-78DDI-R, revised June 1985 or chain of custody protocols as described in Section 5.2 of this QAPjP. The custody requirements are in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and files, are maintained under document control in a secure area. A sample or evidence file is under document control if it:

- is in the possession of the Implementor;
- is in the view of a member of the Implementor after being in that member's possession;
- is in the Implementor's possession and is placed in a secure location; or
- is in a designated secure area.

5.1 Field Custody Procedures

The procedures for sample documentation, labeling, packaging and shipment summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact. The Implementor's QA Officer

will review all field custody documentation to assess whether appropriate procedures were followed during field work and include the findings of this assessment in the QA Reports (see Section 14.0).

Documentation - The field activities associated with the contaminated soil excavation program, the groundwater monitoring program, the surface water monitoring program, the air monitoring program, and the CQA program will be documented in field logbooks. Information to be recorded in the logbooks includes basic site conditions, sequence and duration of events, data related to well installation, groundwater sampling and field measurements. Logbook entries will be described in as much detail as possible so that persons going to the site could re-construct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a centralized secured location in the office when not in use. Each logbook will be identified with a project-specific control number. The title page of each logbook will contain the following:

- Name of person to whom it is assigned;
- Logbook number;
- Project name;
- Project start date; and
- Project end date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used and the signature of the person making the entry will be entered. The names of visitors to the site and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed and dated by the person making the entry. All equipment used to make measurements will be identified. A separate logbook will be dedicated specifically for recording instrument calibration and calibration check data.

Samples will be collected following the sampling procedures documented in the RD FSP, RD AMP, RD HASP, RD CQAP and the RD LTPP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, sample volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

Labeling -- All bottles will be identified with self-adhesive labels. The labels will show the project name, sample number, sample location, time and date of collection, collector initials and intended analysis (see Figure 5). Sample labels will be completed in waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because a labeling pen would not function in freezing weather.

Packaging and Shipment -- The sampling will be performed by personnel who will ship the samples directly to the laboratories within 24 hours of collecting the sample. The Field Team Leader will be personally responsible for the care and custody of the samples until they are shipped to the laboratories.

The samples will be packaged for shipment by placing each container in a separate zip-lock storage bag. The bags will then be placed in a cooler with sufficient packing material (i.e. bubble wrap, Styrofoam peanuts, etc) to adequately protect the containers from breakage, and with sufficient ice or other coolant materials to maintain the temperatures ($4^{\circ}\text{C} \pm 2^{\circ}\text{C}$) required for proper preservation of the samples.

Separate chain-of-custody forms (see Figure 6) will be completed for each cooler of samples. Properly completed chain-of-custody forms will show sample number, location, number and kind of containers, and intended analysis, along with the project name and signatures of the samplers. Each cooler will be closed and secured with strapping tape, and custody seals (see Figure 7) will be placed across the right-front and left-back of the cooler lid. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign, date and note the time on the chain-of-custody form.

5.2 Laboratory Custody Procedures

Laboratory custody procedures are described in the section titled "Sample Custody and Integrity" of GCAL's QAPP which is attached in Appendix I. Laboratory custody procedures will be described in the effluent laboratory's QAPP (after it has been selected) and pending approval by the U.S. EPA.

5.3 Final Evidence Files

Custody of the Implementor's final evidence files will be maintained by the RA Project Coordinator. The files, which will include field logbooks and original laboratory reports, will be kept in a secured, limited access area. The files will be kept in storage for a period of seven years. Files will be offered to EPA prior to disposal.

6.0 CALIBRATION PROCEDURES

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses. These instruments and equipment will be calibrated prior to each use or on a scheduled, periodic basis.

6.1 Field Instruments

Calibration procedures for field instruments are specified in the field measurement SOPs contained in Appendix II of this QAPP.

6.2 Laboratory Instruments

Calibration procedures for laboratory instruments will be those specified in the CLP SOWs being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics) and the laboratory SOPs (attached in Appendices IV, V, and VI) being used to analyze the parameters listed in the Tables.

7.0 ANALYTICAL PROCEDURES

7.1 Field Measurements

Reportable measurements of temperature, pH, conductivity, dissolved oxygen and turbidity will be performed in the field immediately upon sample collection. The analytical procedures for these field measurements are specified in the field measurement SOPs contained in Appendix II of this QAPP. Field screening will be made in accordance with proper operating procedures as described in the RD FSP, RD AMP, RD HASP, RD CQAP, and RD LTPP.

7.2 Laboratory Analysis

The analytical procedures for laboratory testing for organics and inorganics will be CLP SOW (OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics) and the laboratory SOPs (attached in Appendices IV, V and VI) being used to analyze the parameters listed in the Tables.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Field Data

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbooks. These data will be summarized in tabular form for attachment to the technical memoranda and project reports. Any further reduction of the data for evaluation purposes in the reports will be documented therein.

8.2 Laboratory Data

GCAL will perform in-house data reduction and validation in accordance with the section titled "Data Generation, Reduction, and Validation" (see Appendix I) of their written QAPP, the CLP SOWs being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics). Data reporting by GCAL to the Implementor's QA Officer will also conform to the requirements of these SOWs and methods.

A laboratory will be selected to analyze the effluent samples and this laboratory will perform in-house data reduction in accordance with their written QAPP for the effluent parameters listed in Table 9 (when they are identified by BCDES).

Analytical data received from the laboratories will be validated by the Implementor's QA officer in accordance with the following U.S. EPA guidance documents:

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.

The Implementor's QA Officer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and/or analyses may be made by the RA Project Coordinator in conjunction with U.S. EPA's RPM based on the extent of the

deficiencies and their importance in the overall context of the project. The results of all sampling and analysis will be reported to U.S. EPA within 60 days of sample collection.

9.0 INTERNAL QUALITY CONTROL CHECK

9.1 Field QC Checks

QC checks on potential impacts to precision and accuracy from sample collection will be assessed through collection and analysis of field duplicates and field blanks in accordance with the applicable procedures described above in Section 3.0.

QC checks for field measurement of temperature, pH, conductivity, dissolved oxygen and turbidity are limited to the following: (1) Checking the reproducibility of the measurement by obtaining multiple readings on a single sample/standard or location, and (2) by calibration of the instrument at the beginning of the day, at noon, and at the conclusion of the day's sampling or measurement efforts (or as needed based on site-specific requirements).

9.2 Laboratory Analysis

Two mechanisms will be used by the laboratories to ensure the reporting of analytical data of known and documented usable quality: 1) A formal written QAPP and 2) specific QC checks in accordance with that plan, and the applicable CLP SOWs and methods being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics and 40CFR136 for the Table 9 effluent parameters when established by BCDES).

Laboratory QAPP

GCAL maintains a QAPP and QA program, the stated objective of which is to provide legally and scientifically valid laboratory services. The program directs organizational adherence to a system of mandatory operating practices and procedures which ensure that all generated laboratory data are scientifically correct, legally defensible, and fulfilling of applicable regulatory requirements.

Once the effluent laboratory has been selected, its QAPP and QA program will be attached to this QAPjP, pending U.S. EPA approval.

QC Checks

The specific internal QC checks to be used by the laboratories include those specified in the CLP SOWs and in Appendices IV, V, and VI for the methods being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics and 40CFR136 for the Table 90 effluent parameters when established by BCDES).

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPjP. The audits of field and laboratory activities include two separate independent parts: Internal and External audits.

10.1 Field Audits

Internal audits of field activities (sampling and measurements) will be conducted by the Implementor's QA Officer. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. These audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the RA activities. The audits will involve review of field measurement records, instrumentation calibration records and sample documentation.

External audits may be conducted by U.S. EPA Region V personnel at the discretion of the U.S. EPA RPM.

10.2 Laboratory Audits

Internal performance and system audits of the laboratories may be conducted by the Implementor's QA Officer. The systems audits, which would be done on an annual basis, would include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc.

The performance audits may be conducted during this project. Blind QC samples may be prepared and submitted along with project samples to the laboratories for analysis throughout the project. The Implementor's QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratories maintains good performance.

External performance and system audits of the laboratories for approval/disapproval of their performance in the project may be conducted by the U.S. EPA Region V Field Services Section (FSS).

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Instruments

The field instruments for this project include thermometers, pH meters, conductivity meters, dissolved oxygen meters and turbidity meters. The specific preventive maintenance procedures to be followed for field instruments are those recommended by the respective manufacturers. The preventive maintenance schedule is included in Table 8. Internal preventative checks will be conducted at least monthly and will include reviewing the calibration and maintenance logs for each piece of equipment. In addition, the equipment will be turned on and tested to determine that it is functioning properly. The manufacturers will be contacted at least once a year to test the functionality of each piece of equipment.

Field instruments will be checked and calibrated before they are shipped or carried to the field. These instruments will be checked and calibrated daily before use.

Calibration checks of field instruments will be performed three times daily and will be documented in a logbook specifically dedicated to field instrument calibration.

Critical spare parts such as probes, electrodes, batteries, membranes, and standards will be kept on-site to minimize instrument down-time. Back-up instruments will be available on-site or within one-day shipment to avoid delays in the field schedule.

11.2 Laboratory Instruments

As part of their QA/QC Program, a routine preventive maintenance program is conducted by the laboratories to minimize the occurrence of instrument failure and other system malfunctions. GCAL and the effluent laboratory will both have internal groups to perform routine scheduled maintenance, and to repair or to coordinate with the vendor(s) for the repair of all instruments. Critical spare parts such as standards, reagents, columns, syringes, septum, GC/MS filament, will be kept on-site to minimize instrument down-time.

All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific analytical methods being used. The maintenance will be carried out on a regular scheduled basis, and will be documented in the laboratory instrument service logbook for each instrument.

GCAL's specific maintenance procedures are outlined in the section titled "Preventive Maintenance" of their QAPP (Appendix I). Once the effluent laboratory has been selected, its specific maintenance procedures as defined in its QAPP will be attached to this QAPjP, pending approval by the U.S. EPA.

12.0 DATA ASSESSMENT PROCEDURES

12.1 Field Data

Field data will be assessed for accuracy, precision, and completeness by the Implementor's QA Officer. Accuracy will be assessed using instrument-calibration and calibration-check data obtained on a daily basis.

Precision will be assessed on the basis of reproducibility by comparing multiple readings from a single sample. At a minimum, multiple readings will be obtained every tenth measurement. Data completeness will describe the number of valid data measurements obtained as a percentage of the total number of data measurements planned.

12.2 Laboratory Data

All analytical data will be evaluated for precision, accuracy, completeness and sensitivity. The acceptability of the analytical precision and accuracy will be determined by comparing them to the control limits recommended in the CLP SOWs and methods being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics and 40CFR136 for the Table 9 effluent parameters when established by BCDES). Data determined to be insufficiently precise or accurate will be subject to the corrective action prescribed by the appropriate analytical method. The QC samples used in the determination of precision and accuracy have been described in Section 9.0. Specific equations used to calculate precision, accuracy and completeness are presented below:

Precision will be expressed in terms of relative percent difference (RPD).

$$RPD = \frac{(\text{Concentration 1} - \text{Concentration 2})}{(\text{Concentration 1} + \text{Concentration 2})/2} \times 100$$

Accuracy as determined from the analysis of an external reference standard will be expressed as percent recovery (%R).

$$\% R = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Accuracy as determined from the analysis of a spiked sample will also be expressed percent recovery.

$$\% R = \frac{(\text{Spiked Sample Concentration} - \text{Sample Concentration})}{\text{Concentration of Spike Added}} \times 100$$

Completeness will describe the number of usable analytical results as a percentage of the total number of results expected for the samples submitted for analysis.

$$\% \text{ Complete} = \frac{\text{Number of Usable Results}}{\text{Total Number of Results}} \times 100$$

Analytical sensitivity, or the achievement of method detection limits, depends on instrumental sensitivity and matrix effects. Thus, it is important to monitor instrumental sensitivity to ensure the data quality through constant instrument performance. The instrumental sensitivity will be monitored through the analysis of method blanks, calibration check samples and laboratory control samples.

13.0 CORRECTIVE ACTIONS

Corrective actions must be taken any time a situation develops that threatens data quality. Corrective action may be required if field or laboratory audits reveal unacceptable deviation from approved procedures. It may be required any time duplicate or spiked sample analyses exceed the QC limits or when blank analyses indicate unacceptable levels of contamination. Corrective actions for the field activities will be initiated as needed based on:

- A daily review of the implementation of the field activities by the Field Team Leader;
- A field sampling/data collection problem identified by a sampling team member;
- A daily review of the field data by the Field Team Leader; and/or
- A review of the field activities by other personnel.

Corrective actions will be initiated when:

- The field investigations are not implemented per the RD FSP, RD AMP, RD CQAP, or the RD LTPP;
- Site conditions require a modification to the identified sampling procedures in order to meet the Skinner Landfill DQOs;
- Equipment fails to properly operate in the field; and/or
- Field sampling and data collecting procedures warrant a corrective action.

The Implementor's QA Officer will approve corrective actions before implementation. Corrective actions will be initiated by the Field Team Leader and will be implemented by the appropriate personnel.

A corrective action may include immediate resampling and/or reanalysis of a few samples, or the cessation of all analyses with the subsequent resampling and/or reanalysis of all samples upon resolution of the problem.

Specific corrective actions for field measurements may include the following:

- Repeat the measurement to check the error;
- Check for all proper adjustments for ambient conditions such as temperature;
- Check the batteries;
- Check the calibration and adjust as necessary;
- Replace the instrument or measurement devices; and/or
- Stop work (if necessary).

Specific corrective actions for analytical measurements are described in the CLP SOWs being used for this project (i.e., OLM04.2 or most current method for organics and CLP SOW ILM04.0 or most current method for inorganics), the Laboratory QAPPs and procedures in Appendices IV, V, and VI for methods listed in 40CFR136 for the Table 9 effluent parameters (when established by BCDES). Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective action may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above the acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the Laboratory QA Departments during internal or external audits or from the results of performance evaluation samples; and/or
- Inquiries concerning data quality are received.

A QC problem that cannot be solved by immediate corrective action must be thoroughly investigated to determine the extent of the problem and to ensure that all samples affected by the problem are identified and analyzed.

14.0 QUALITY ASSURANCE REPORTS

Analytical data will be validated in accordance with the following U.S. EPA guidance documents:

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999.

- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.

Summary QA Reports will accompany the analytical results from the RA sampling and analysis activities in a technical memorandum or project report when these are submitted to U.S. EPA. The QA Reports will include an assessment of data quality based on the QC data, results of any performance and system audits if performed, as well as an account of any significant QA problems encountered and corrective action taken. These QA reports will be generated for each for each sampling event. A separate report detailing project status, any significant QA proposed corrective action, and any changes in the QAPP or FSP will be generated by the QA Officer or his designee. The Implementor's QA Officer will be responsible for preparing the QA Reports. The QA reports and analytical data will be issued to the U.S. EPA RPM by the RA Project Coordinator.

15.0 REFERENCES

USEPA, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (QAMS-005/80), EPA-600/4/83-004

USEPA, *EPA requirements for Quality Assurance Project Plans for Environmental Data Operation*, EPA QA/R-5, August 1994.

USEPA, Office of Emergency and Remedial Response, 1994, USEPA Contract Laboratory Program. *National Functional Guidelines for Inorganic Data Review*.

USEPA, Office of Emergency and Remedial Response, 1999, USEPA Contract Laboratory Program. *National Functional Guidelines for Organic Data Review*.

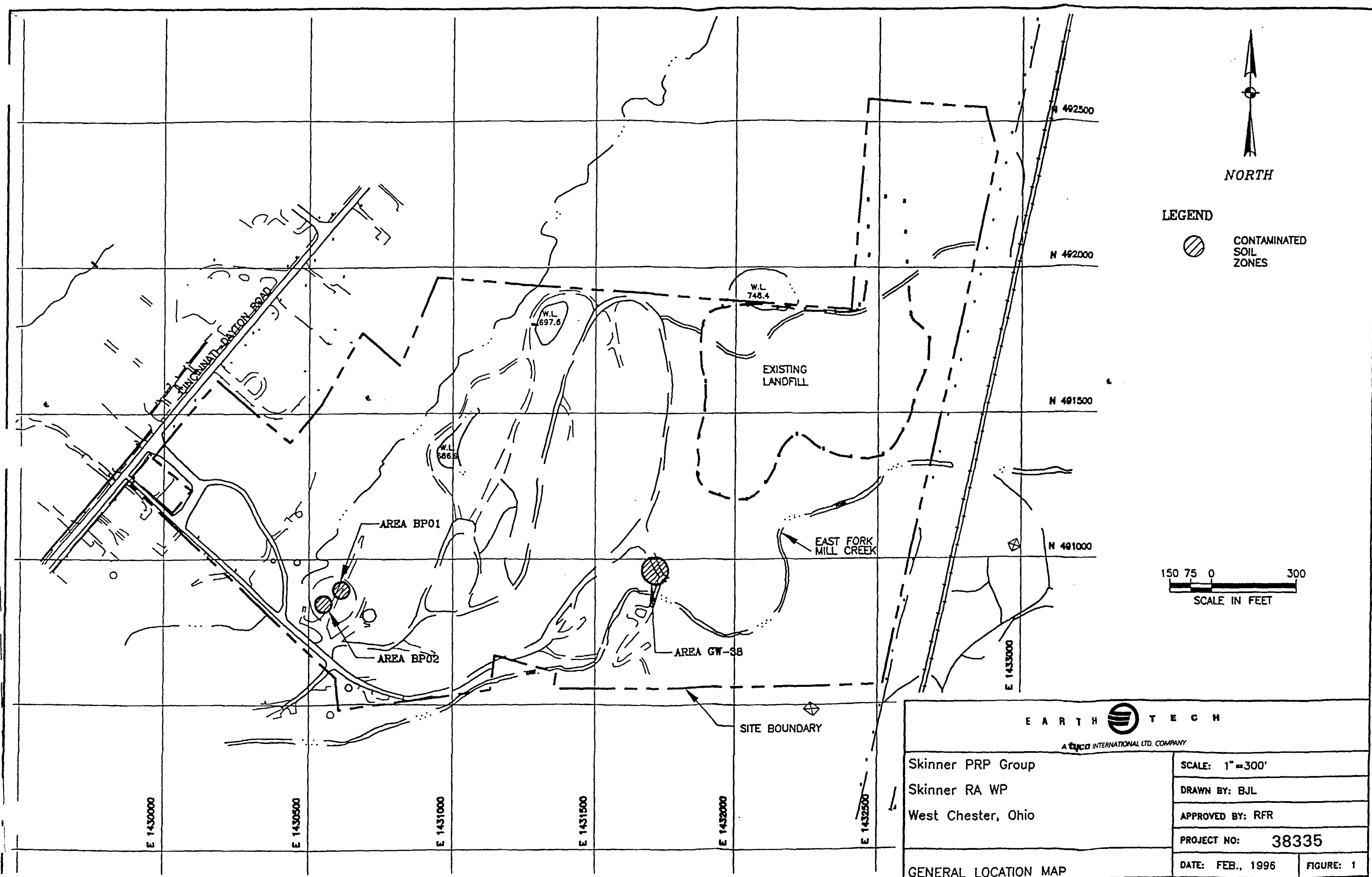
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USEPA, *Model Mini-QAPjP*, 1993.

USEPA, *Policies and Procedures*, EPA-330/9-78DDI-R, revised June 1985.

Ohio EPA Division of Surface Water, *Primary Headwater Assessment Program Field Evaluation Manual*, June 1999.

FIGURES



NOTE: THIS CAD0 DRAWING IS SET UP IN AUTOCAD'S PAPERSPACE ALTERATIONS
MAY BE NECESSARY FOR FILE TRANSLATION TO OTHER CAD0 PROGRAMS.

XREF FILES: G:\PROJ\72680\XREF\SKNSPR94.A00

FILE: SK11X171.A00 DIR: \72680

PLOT DATE: 02/22/96

GENERAL LOCATION MAP

Skinner PRP Group
Skinner RA WP
West Chester, Ohio

SCALE: 1"=300'

DRAWN BY: BJL

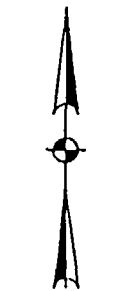
APPROVED BY: RFR

PROJECT NO: 38335

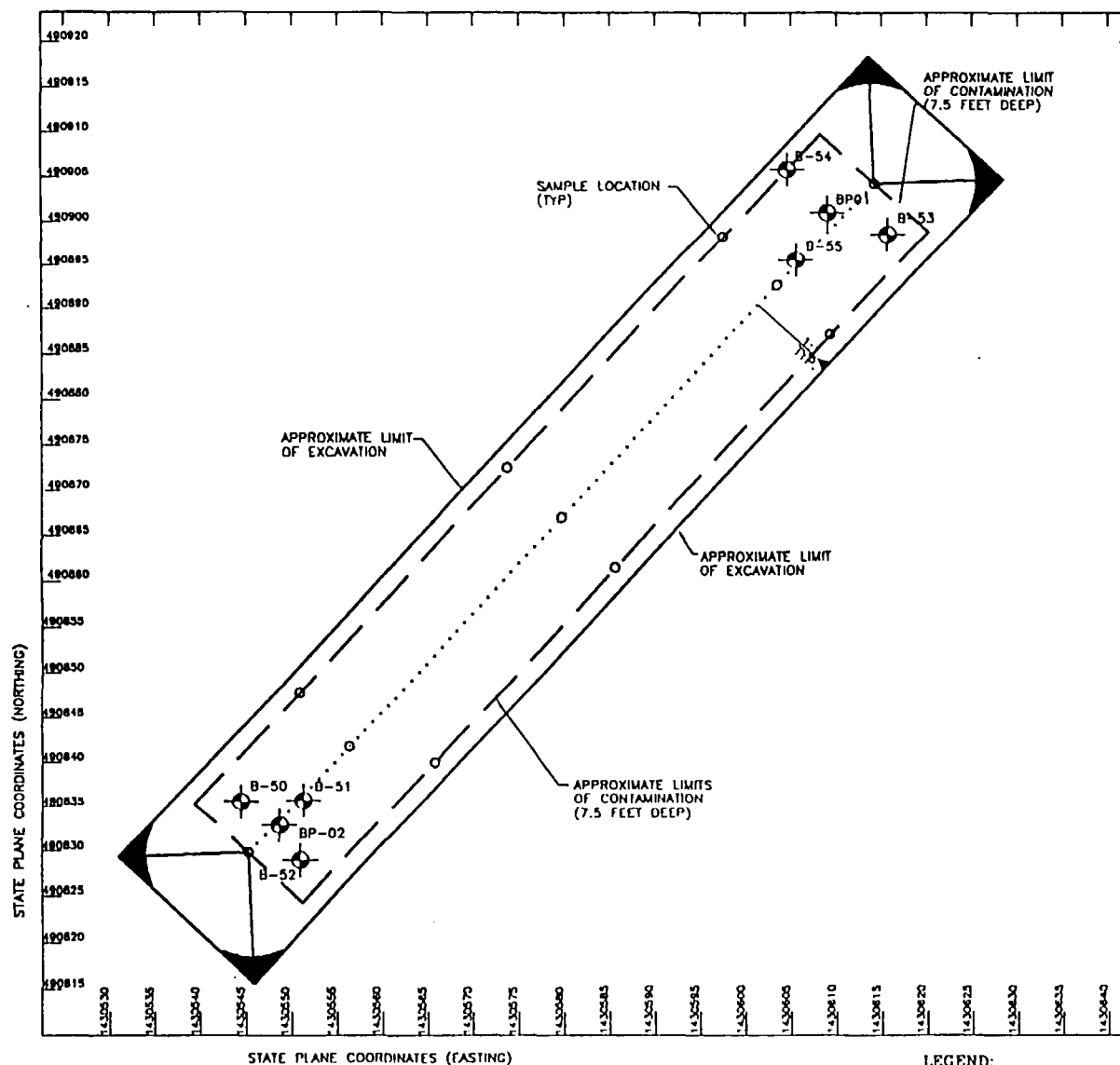
DATE: FEB., 1996

FIGURE: 1

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY



NORTH



LEGEND:

- SAMPLE LOCATIONS
- 10 FOOT EXCAVATION LINE



Skinner PRP Group

Skinner RA WP

West Chester, Ohio

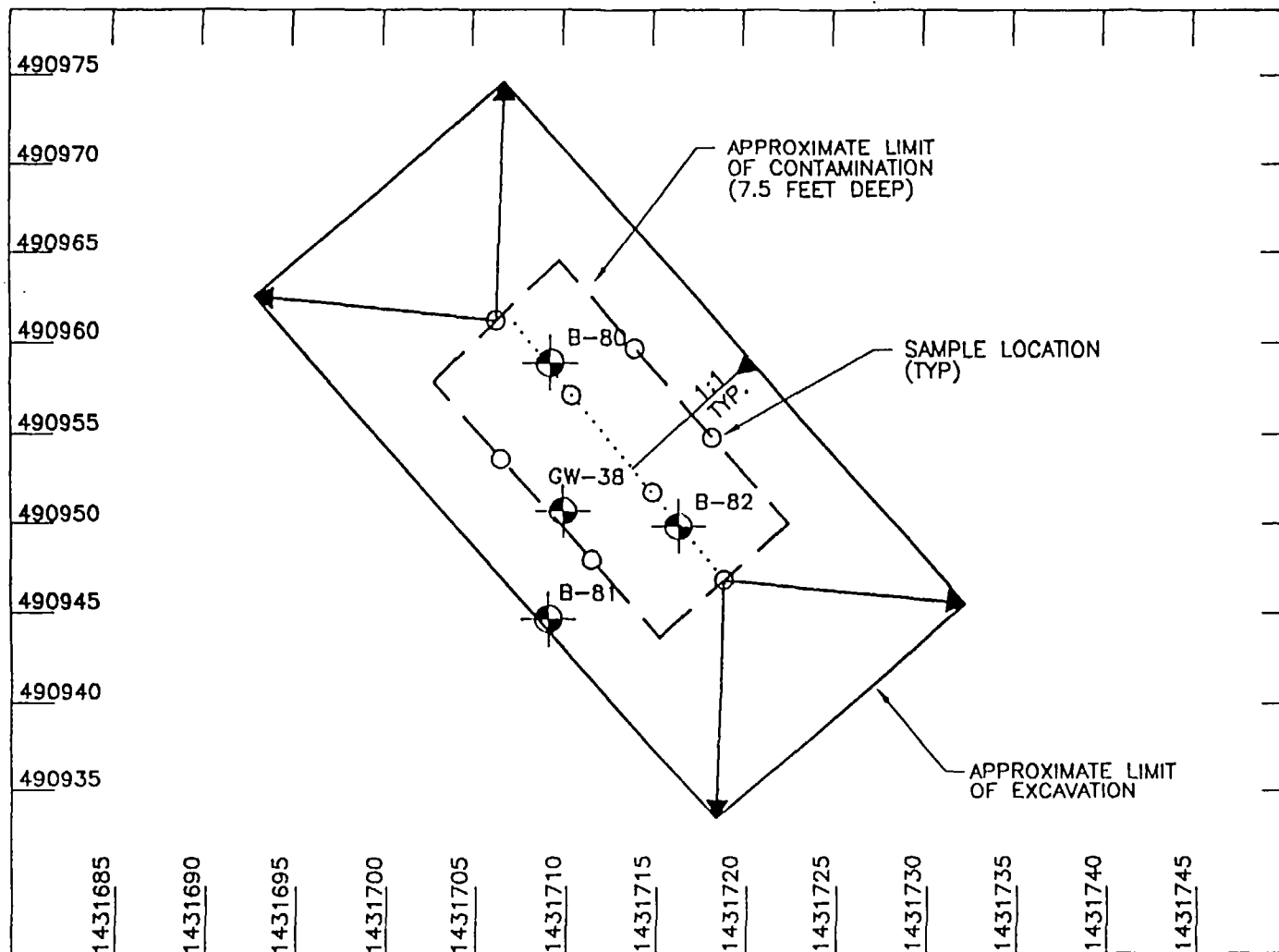
CONTAMINATED SOIL LIMITS- AREA BP01/BP02

EARTH  TECH

A **tyco** INTERNATIONAL LTD COMPANY

PROJECT NO. 38335 FIGURE 2

STATE PLANE COORDINATES (NORTHING)



STATE PLANE COORDINATES (EASTING)

LEGEND:

- SAMPLE LOCATIONS
- 10 FOOT EXCAVATION LINE



Skinner PRP Group

Skinner RA WP

West Chester, Ohio

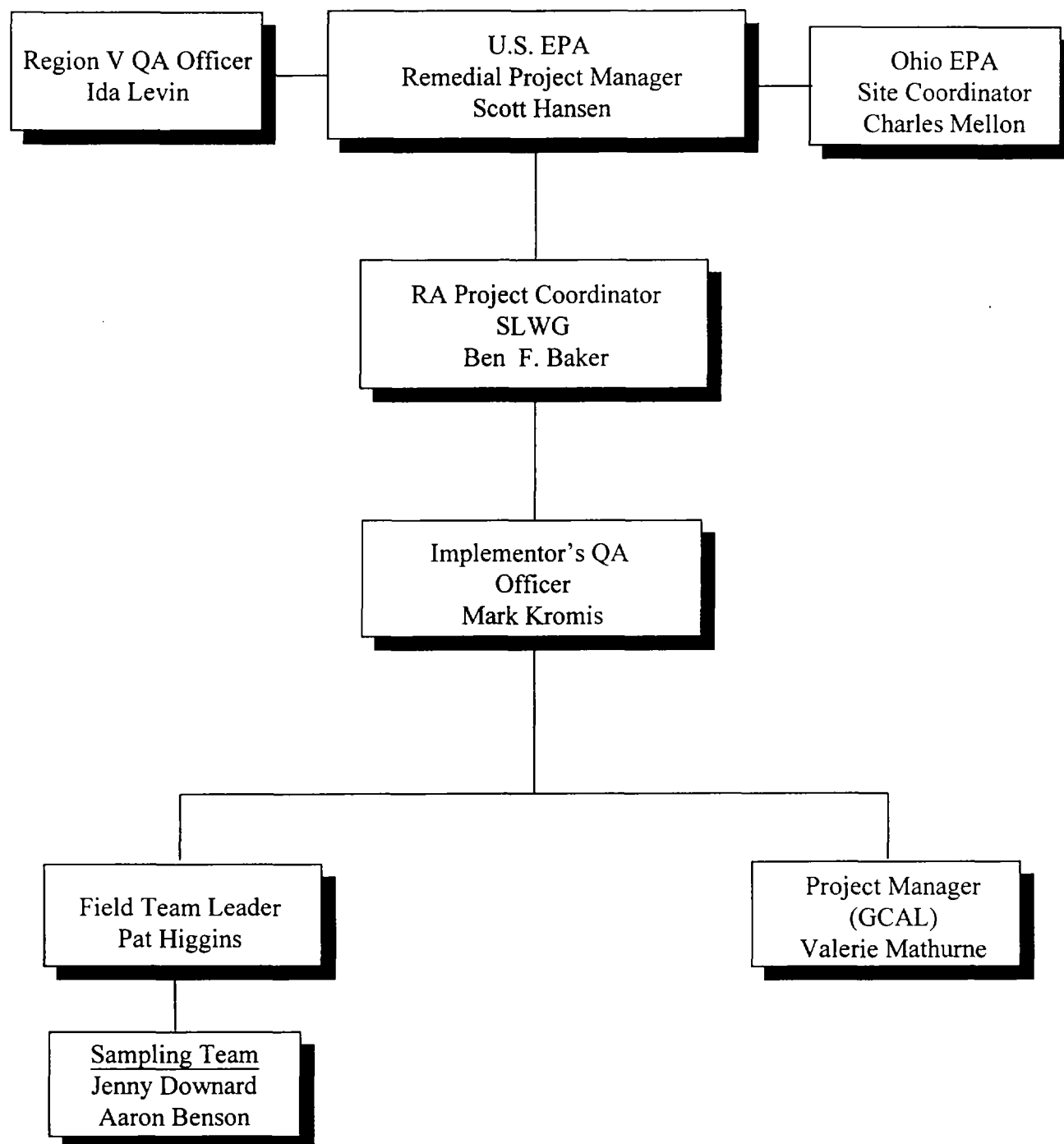
CONTAMINATED SOIL LIMITS-AREA GW-38



A **tyco** INTERNATIONAL LTD. COMPANY

PROJECT NO. 38335 FIGURE 3

Figure 4
QAPP Organization Chart





Preservative: None
Parameter:

Sample ID: _____

Date: _____ Time: _____

Comp.: _____ Grab: _____

Sampled by: _____

GCAL-01

Figure 5: Sample Label



Lab use only

Client Name

Client #

Group #

Due Date

Report to:

Bill to:

Analytical Requests & Method

Lab use only:

Client: _____

Client: _____

Address: _____

Address: _____

Contact: _____

Contact: _____

Phone: _____

Phone: _____

Fax: _____

Fax: _____

P.O. Number

Project Name/Number

Sampled By

Matrix ¹	Date	Time (2400)	Comp	Grab	Sample Description	Preservatives	No Containers
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Lab ID

Remarks:

Turn Around Time: ☐ 24-48 hrs.* ☐ 3 days* ☐ 1 week* ☐ Standard ☐ Other

Relinquished by: (Signature)

Received by: (Signature)

Date:

Time:

Note: * Non-standard turnaround time request must be pre-scheduled with Laboratory.

Relinquished by: (Signature)

Received by: (Signature)

Date:

Time:

Relinquished by: (Signature)

Received by: (Signature)

Date:

Time:

By submitting these samples, you agree to the terms and conditions contained in our most recent schedule of services.

Figure 6: Chain-of-Custody Form

Matrix¹: W = water, S = soil, SD = solid, L = liquid, SL = sludge, O = oil, CT = charcoal tube, A = air bag

We cannot accept verbal changes. Please fax written changes to (225) 767-5717

WHITE: CLIENT FINAL REPORT — CANARY: LABORATORY — PINK: CLIENT

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GULF COAST
ANALYTICAL LABORATORIES, INC.



CUSTODY SEAL

This package conforms to the conditions
and limitations specified in 49 CFR 173.4

Date Sealed: _____

Sealed by: _____

GCAL-17

Figure 7: Custody Seal

TABLES

TABLE 1

**SKINNER LANDFILL REMEDIAL ACTION
SAMPLING AND ANALYSIS PROGRAM SUMMARY**

Sample Matrix (1)	No. of Samples per event	Field Dups. (2)	Field Blanks (2)	MS/MSD (3)	Trip Blanks (4)	Total Samples per event	Test Parameters (5)
Soil	19	2	-	1	-	22	TCL PCBs, TCL PAHs, and TAL Lead. See Table 3 for parameters.
RA Construction Surface Water Monitoring, at SW-50, SW-51, SW-52, SW-53, & SW-54) unfiltered (6)	5	1	1	1	1	9	See Tables 4, 5, 7 and 8 for parameters.
Surface Water Run-off Monitoring unfiltered (6)	3	1	1	1	1	7	See Tables 4, 5, and 7 for parameters.
Re-evaluate/Confirm Baseline Surface Water Conditions (at SW-50, SW-51, SW- 52 & SW-53) unfiltered (7)	4	1	1	1	1	8	See Tables 4, 5, 7 and 8 for parameters.
Re-evaluate/Confirm Baseline Groundwater Monitoring Conditions, metals filtered and un-filtered (7)	11	2	2	1	1	17	See Tables 4, 5, and 7 for parameters.

- Notes:
- (1) All samples are considered low/medium environmental samples.
 - (2) For surface water and run-off sampling, one field duplicate and one field blank will be collected during each sampling event. For other sampling, one field duplicate and one field blank will be collected every 10 or fewer investigative samples.
 - (3) MS/MSD consists of extra volume collected for one of the investigative samples. They will be collected at the rate of one for each surface water and out-fall sampling event and at the rate of one for every 20 or fewer investigative samples for other media. (Triple ADDITIONAL volume for VOCs, double ADDITIONAL volume for SVOCs). Laboratory duplicate analysis must be performed on an aliquot from the original one liter (1L) investigative sample container; no extra volume is required.
 - (4) One trip blank will be included with each shipment of aqueous VOC samples.
 - (5) Field parameters will be collected for aqueous samples and may include temperature, pH, specific conductance, and dissolved oxygen.
 - (6) Surface water run-off sampling will be done monthly until completion of the RA cover and trench/cut-off wall system construction activities. Samples listed are per sampling event. Run-off samples will only be collected after a rain event.
 - (7) Surface water and groundwater samples will be collected at selected sample locations at the end of the RA construction activities to re-evaluate and confirm the baseline conditions defined during the GWDI.

TABLE 2

SKINNER LANDFILL REMEDIAL DESIGN
SITE-SPECIFIC GROUNDWATER INTERCEPTION PARAMETERS AND
REVISED MODIFIED TRIGGER LEVELS

CONTAMINANT	CONCENTRATION (mg/L) (1)
INORGANICS	
Antimony	0.06
Arsenic	0.01
Barium	1.0
Beryllium	0.005
Cadmium	0.005
Chromium (total)	0.011
Copper	0.025
Cyanide	0.01
Iron	5.0
Lead	0.0042
Mercury	0.0002
Nickel	0.096
Selenium	0.005
Silver	0.01
Thallium	0.04
Zinc	0.086
VOLATILES	
Benzene	0.005
2-Butanone	0.0071
Carbon Tetrachloride	0.005
Chlorobenzene	0.026
Chloroform	0.079
1,2-Dichloroethane	0.005
1,2-Dichloroethene (cis)	0.07

TABLE 2 - CONT

SKINNER LANDFILL REMEDIAL DESIGN
SITE-SPECIFIC GROUNDWATER INTERCEPTION PARAMETERS AND
REVISED MODIFIED TRIGGER LEVELS

CONTAMINANT	CONCENTRATION (mg/L) (1)
<u>VOLATILES - CONT</u>	
1,2-Dichloroethene (trans)	0.01
1,2-Dichloropropane	0.005
Ethylbenzene	0.062
Styrene	0.056
1,1,2,2-Tetrachloroethane	0.107
Tetrachloroethene	0.005
Toluene	1.0
1,1,1-Trichloroethane	0.088
1,1,2-Trichloroethane	0.418
Trichloroethene	0.005
Vinyl Chloride	0.002
Xylenes (total)	10.0
<u>SEMI-VOLATILES</u>	
Acenaphthene	0.52
Benzo(a)anthracene	0.01
Benzo(b)fluoranthene	0.01
Benzo(k)fluoranthene	0.01
Benzo(g,h,i)perylene	0.01
Benzo(a)pyrene	0.01
bis(2-Chloroethyl)ether	0.0136
bis(2-Ethylhexyl)phthalate	0.049
Butylbenzylphthalate	0.01
Chrysene	0.01

TABLE 2 - CONT

SKINNER LANDFILL REMEDIAL DESIGN
SITE-SPECIFIC GROUNDWATER INTERCEPTION PARAMETERS AND
REVISED MODIFIED TRIGGER LEVELS

CONTAMINANT	CONCENTRATION (mg/L) (1)
SEMI-VOLATILES - CONT	
Dibenzo(a,h)anthracene	0.01
1,2-Dichlorobenzene	0.011
1,3-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.075
2,4-Dimethylphenol	2.12
Dimethyl phthalate	0.073
Di-n-butyl phthalate	0.19
Fluoranthene	0.01
Hexachloroethane	0.01
Indeno(1,2,3-cd)pyrene	0.01
Isophorone	0.9
Naphthalene	0.044
Nitrobenzene	27.0
4-Nitrophenol	0.15
2,2'-oxybis (1-Chloropropane)	4.36
Phenol	0.37
1,2,4-Trichlorobenzene	0.077
Phenanthrene	0.01

- (1) The concentrations shown in this table are not detection limits. CRQLs for these parameters are shown in Tables 4 through 8.

TABLE 3

SKINNER LANDFILL REMEDIAL DESIGN
PARAMETERS AND REMEDIAL TRIGGER LEVELS FOR
CONTAMINATED SOILS EXCAVATIONS

CONTAMINANT	CONCENTRATION (mg/Kg) (1)
Polychlorinated Biphenyls - Total	0.160
Benzo(a)anthracene	0.330
Benzo(a)pyrene	0.100
Benzo(b)fluoranthene	0.330
Benzo(k)fluoranthene	0.330
Chrysene	0.330
Lead	500.0

- (1) The concentrations shown in this table are not detection limits. CRQLs for these parameters are shown in Tables 4 through 8.

TABLE 4

SKINNER LANDFILL REMEDIAL DESIGN
TARGET COMPOUND LIST VOLATILES AND
CONTRACT REQUIRED QUANTITATION LIMITS

		Quantitation Limits
Volatiles	CAS Number	Water (ug/L)
1. Vinyl Chloride	75-01-4	10
2. 1,2-Dichloroethene (cis)	156-59-4	10
3. 1,2-Dichloroethene (trans)	156-60-5	10
4. 1,3-Dichlorobenzene	541-73-1	10
5. 1,4-Dichlorobenzene	106-46-7	10
6. 1,2-Dichlorobenzene	95-50-1	10
7. Chloroform	67-66-3	10
8. 1,2-Dichloroethane	107-06-2	10
9. 2-Butanone	78-93-3	10
10. 1,1,1-Trichloroethane	71-55-6	10
11. Carbon Tetrachloride	56-23-5	10
12. 1,2-Dichloropropane	78-87-5	10
13. Trichloroethene	79-01-6	10
14. 1,1,2-Trichloroethane	79-00-5	10
15. Benzene	71-43-2	10
16. Tetrachloroethene	127-18-4	10
17. Toluene	108-88-3	10
18. 1,1,2,2-Tetrachloroethane	79-34-5	10
19. Chlorobenzene	108-90-7	10
20. Ethyl benzene	100-41-4	10
21. Styrene	100-42-5	10
22. Xylenes (total)	1330-20-7	10

TABLE 5

SKINNER LANDFILL REMEDIAL DESIGN
TARGET COMPOUND LIST SEMI-VOLATILES AND
CONTRACT REQUIRED QUANTITATION LIMITS

Semi-volatiles (2)	CAS Number	Quantitation Limits	
		Water (ug/L)	Soil/Sediment (mg/Kg) (1)
1. Phenol	108-95-2	10	330
2. bis(2-Chloroethyl) ether	111-44-4	10	330
3. 2,2'-oxybis-(1-Chloropropane) (3)	108-60-1	10	330
4. 7. Hexachloroethane	67-72-1	10	330
5. 8. Nitrobenzene	98-95-3	10	330
6. 9. Isophorone	78-59-1	10	330
7. 10. 2,4-Dimethylphenol	105-67-9	10	330
8. 11. 1,2,4-Trichlorobenzene	120-82-1	10	330
9. 12. Naphthalene	91-20-3	10	330
10. 13. Dimethylphthalate	131-11-3	10	330
11. Acenaphthene	83-32-9	10	330
12. 4-Nitrophenol	100-02-7	25	830
13. Phenanthrene	85-01-8	10	330
14. Di-n-butyl phthalate	86-74-2	10	330
15. Fluoranthene	206-44-0	10	330
16. Butyl benzyl phthalate	85-68-7	10	330
17. <u>Benzo(a)anthracene</u>	56-55-3	10	333
18. <u>Chrysene</u>	218-01-9	10	330
19. bis(2-Ethylhexyl)phthalate	117-81-7	10	330
20. <u>Benzo(b)fluoranthene</u>	205-99-2	10	330
21. <u>Benzo(k)fluoranthene</u>	207-08-9	10	330
22. <u>Benzo(a)pyrene</u>	50-32-8	10	330
23. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
24. Dibenzo(a,h)anthracene	53-70-3	10	330
25. Benzo(g,h,i)perylene	191-24-2	10	330

- (1) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the protocol, will be higher.
- (2) Underline parameters are the site specific parameters of interest defined in the ROD and RD SOW as listed in Table 3.
- (3) Previously known by the name bis(2-Chloroisopropyl) ether.

TABLE 6

SKINNER LANDFILL REMEDIAL DESIGN
TARGET COMPOUND LIST PESTICIDES & PCBs AND
CONTRACT REQUIRED QUANTITATION LIMITS

		Quantitation Limits	
Pesticides/Aroclors	CAS Number	Water (ug/L)	Soil/Sediment (mg/Kg) (1)
1. AROCLOR-1016	12674-11-2	1.0	33.0
2. AROCLOR-1221	11104-28-2	2.0	67.0
3. AROCLOR-1232	11141-16-5	1.0	33.0
4. AROCLOR-1242	53469-21-9	1.0	33.0
5. AROCLOR-1248	12672-29-6	1.0	33.0
6. AROCLOR-1254	11097-69-1	1.0	33.0
7. AROCLOR-1260	11096-82-5	1.0	33.0

(1) Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the protocol, will be higher.

TABLE 7

SKINNER LANDFILL REMEDIAL DESIGN
TARGET ANALYTE LIST INORGANICS AND
CONTRACT REQUIRED QUANTITATION LIMITS

Analyte (4)	Contract Required (1, 2, 3) Quantitation Limit (ug/L)
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Chromium	10
Copper	25
Iron	100
<u>Lead</u>	3
Mercury	0.2
Nickel	40
Selenium	5
Silver	10
Thallium	10
Zinc	20
Cyanide	10

- (1) Higher detection limits may only be used if the sample concentration exceeds five times the detection limit of the instrument or method in use. The value may be reported even though the instrument or method detection limit may not equal the CRQL. This is illustrated in the example where the value of 220 may be reported even though the instrument detection limit is greater than the CRQL.

For lead: Method in use = ICP
Instrument Detection Limit (IDL) = 40
Sample Concentration = 220
CRQL = 3

- (2) The CRQL's are the instrument detection limits obtained in pure water. The detection limits for samples may be considerably higher depending on the sample matrix.
- (3) The CRQL's for soils = 200 times CRQL's for water.
- (4) Underlined parameter is the site specific parameter of interest defined in the ROD and RD SOW as listed in Table 3.

TABLE 8

SKINNER LANDFILL REMEDIAL DESIGN
PREVENTIVE MAINTENANCE SCHEDULE

Instrument Type/Model Number	Manufacturer/Supplier	Preventative Maintenance Check/Service Call to Manufacturers
pH Meter Model 607 Model 5985-80 Model 123133 - Unit 1	Fisher Cole Parmer Beckman	Monthly/Annual Monthly/Annual Monthly/Annual
Conductivity Meter Model 33	YSI	Monthly/Annual
Dissolved Oxygen Meter Model 55 Model 57	YSI YSI	Monthly/Annual Monthly/Annual

TABLE 9

SKINNER LANDFILL REMEDIAL DESIGN
PARAMETERS TO BE ANALYZED FOR
DISCHARGE TO BCDES

NOTE: This table will be completed when BCDES issues authorization to discharge.

APPENDICES

APPENDIX I

SELECTED SECTIONS FROM GCAL
QUALITY ASSURANCE PROGRAM PLAN

ADMINISTRATIVE ORGANIZATION

Gulf Coast Analytical Laboratories is organized along clear lines of authority to provide our clients with service that is efficient and reliable. To assure communication between the departments, key personnel meet weekly, or more frequently as needed to discuss and coordinate the activities in the laboratory. The laboratory personnel also meet daily with project management to discuss key issues for that day.

It is the policy of the laboratory that at each management and operational level a designated deputy or deputies will maintain continuity of service and other functions in the event of absence of key staff.

Each department within the laboratory has specific roles and responsibilities in terms of producing a product of known quality. All laboratory personnel are expected to have a working knowledge of the Quality Assurance Program Plan.

The General Manager bears the primary responsibility for data quality at the laboratory. The General Manager directs the functional areas of marketing, finance and administration for the laboratory.

The Operations Manager is responsible for coordinating the activities of analysts and technicians. The Operations Manager assures the commitment of sufficient resources for the timely generation of data of a known quality. The technical operation of the laboratory is the responsibility of the Operations Manager.

The Technical Services Manager is responsible for coordinating the activities of the sample administration department, client services, and administrative support personnel.

The Information Technology Director manages the implementation and development of information technology tools. He is also responsible for the automated data collection systems used by the laboratory. He performs strategic planning for IT projects based on projected needs of the Laboratory. Interacts with clients to determine IT requirements such as electronic deliverables.

The QA/QC Director is responsible for the preparation and maintenance of the laboratory Quality Assurance Program Plan. The QA/QC Director acts as the official laboratory contact for audits, performance evaluation studies, and project-specific quality control issues. The QA/QC Director approves and confirms the implementation of corrective actions. The QA/QC Director is responsible for the approval and distribution of controlled documents. The QA/QC Director has the authority to intercede in all areas where quality related problems exist. No work will be released until the related quality deficiency has been corrected and approval has been given to proceed forward.

Department Supervisors are responsible for the overall flow of work and data through the laboratory. They are responsible for the maintenance of accurate SOP's. Further responsibilities include general management of all activities within their department, ensuring that all instrumentation and equipment meet performance criteria and calibration requirements, and training of laboratory staff. The Supervisor is responsible for validating data released from the department. Department Supervisors inform the Operations Manager or Technical

Services Manager of project status and capacity issues.

Project Managers act as liaisons between the laboratory and the client. Responsibilities include sample scheduling, communicating project-specific requirements to laboratory personnel, review of log-in summaries, notifying the client of any sample receipt or analytical problems, monitoring the progress of analytical work, and providing data to clients in a timely manner. Project Managers document client complaints.

At the bench level, analysts are responsible for the generation of data by analyzing samples according to written SOP's. They are also responsible for ensuring that all documentation related to the analysis is accurate and complete. The analyst should inform the Department Supervisor of quality problems immediately. The analysts have the authority to accept or reject data based on compliance with QC acceptance criteria. Analysts are responsible for initial review of all data.

The Data Validation Manager is responsible for review of final reports. Any discrepancies found in the data is reported to the appropriate Department Supervisor for review and correction if necessary.

Sample Custody and Integrity

GCAL utilizes a Laboratory Information Management System (LIMS) that was specifically developed for the needs of GCAL. The MULTI-LIMS, developed by Advanced Systems Management, Inc. tracks samples and analytical data throughout the laboratory. Results are available from the LIMS package in a variety of hard copy formats. Furthermore, computer terminals can be provided to clients who wish to view their data via modem. A built in security system prevents a client from viewing any data other than their own.

The following is an example of some of the information that is entered into the system:

1. Sample number (unique to this sample)
2. Job number (unique to this job or set of samples)
3. Date received
4. Time received
5. Date analytical results due
6. Sample description
7. Identifying marks
8. Customer's name
9. Customer's address
10. Group number
11. Storage location
12. Notation of any special handling instructions or priority assignments
13. Billing information - purchase orders
14. Analyses requested

The Sample Administration Department also maintains an electronic log of all samples received. The log includes basic information concerning the samples including; date of receipt, client, matrix and tests assigned. The information is stored with the final report.

GCAL understands that sample integrity is a vital part of Quality Assurance. Samples submitted to the laboratory should be logged in immediately. If there must be a delay in this process, log-in should be aware of those samples requiring refrigeration and store them accordingly. Any sample that is suspected of being contaminated, improperly stored or preserved, or improperly prepared, should be reported to the client immediately. Storage blanks located in the volatiles refrigerators are analyzed every two weeks. Records of these analyses are maintained in the GC and GC/MS Volatiles laboratories. No sample is analyzed

if there is a question concerning its integrity.

After the sample analyses are complete and the final report is issued to the client, samples are held for 60 days from receipt before disposal. Samples may be held longer per the customer request. All customers are encouraged to take possession of their remaining sample after analysis.

Chain of Custody

A complete chain of custody is maintained by GCAL. Each sample when submitted to our laboratory is accompanied by a Chain of Custody form (Figure 3). These forms contain pertinent information about the sample including specific analytical requests, sampling notes, sample condition, customer name and address.

Additionally, information concerning the site name, field identification marks, date and time of collection, sampler signature, and preservation data is recorded.

Samples are tagged, preserved if necessary and stored appropriately (i.e. refrigerator, freezer or shelf). Samples to be analyzed for volatile organic compounds are stored in refrigerators located in the volatiles analytical laboratories.

Custody Transfer

If a sample requires additional work to be performed by a qualified outside laboratory, a chain of custody form is completed and submitted with a representative portion of the sample. A copy of this form is maintained on file along with similar information located in a logbook. The chosen laboratory must sign and date the form upon receipt and return it, along with any unused sample, upon completion of analysis.

PREVENTIVE MAINTENANCE

In order to prevent system down time, minimize corrective maintenance cost and to help insure data validity, GCAL uses a system of preventive maintenance.

Specific operator manuals are used to pinpoint steps in the preventive maintenance scheme for individual instruments. All routine maintenance is performed as recommended by the manufacturer. These manuals also assist in identification of commonly needed replacement parts so that an inventory of these parts can be properly maintained.

Maintenance contracts are purchased for most instruments. This insures periodic preventive maintenance visits by factory authorized service representatives and immediate service for corrective actions if required.

An instrument log, found in Appendix C, is associated with each instrument. Notation of the date and preventive maintenance activity is recorded when performed. This includes routine service checks by laboratory personnel as well as factory service calls. Instrumentation logs are periodically reviewed by the QA manager and the information contained in them is used to help identify long and short term equipment needs of the laboratory. This log also provides a written source for future use in preventive maintenance. A preventive maintenance SOP details the frequency and type of routine maintenance required for laboratory instrumentation.

Maintenance logs are also used for ovens, refrigerators, incubators, etc.. The log is to ensure that every facet in the operation of this lab is correctly documented.

Calibration curves, verification standards and internal standards insure that an instrument produces acceptable results. If calibration values do not conform to the expected results, calibration is repeated. An operator may perform routine maintenance at this point if problems persist. Some examples of these tasks would be the replacement of a nebulizer, adjusting an uptake level, cleaning a mixing chamber or replacing a column. Intensive maintenance is performed by authorized representatives of the instrument manufacturer.

All balances are serviced by an external certified service engineer semi-annually. Analytical balances are calibrated daily, using Class S weights. The Class S weights are recertified annually. Daily temperature logs are also kept for other instrumentation to insure reliable analytical data. All liquid-in-glass thermometers used for recording temperatures are calibrated against a NIST-traceable thermometer yearly. The calibration of dial-type thermometers and temperature probes are checked quarterly against a NIST-traceable thermometer. The barometer will be calibrated against an NIST-traceable barometer yearly.

When a piece of equipment is deemed defective, it is taken out of service and identified with an orange "OUT OF SERVICE" label. For support equipment such as balances, ovens, coolers, and pipettors, the QA/QC Department is notified so that proper servicing and repair can be scheduled. Routine and preventive maintenance for major instrumentation is performed by the analysts. If outside service is necessary, it is scheduled by the Department Supervisor with approval from the Operations Manager. Satisfactory instrument performance must be verified prior to returning to service any repaired equipment.

Data Generation, Reduction, and Validation

Initial data reduction is the responsibility of the analyst who performs the analysis and/or operates an instrument.

Each analyst records all manually generated data in a log book associated with the analysis or type of analysis being performed. The spike recoveries and precision for duplicates are calculated and recorded in the logbook. The analysts verifies that all sample identifications are accurate.

Data reduction includes all activities that convert instrument/computer responses into reportable results. This may involve calculations, compound identification, and QC sample calculations. Final results are obtained by direct reading from the instrument or calculations based on instrument readings, output, or responses. Manual data reduction is performed by calculating results with the appropriate formula. Manually entered information such as the sample ID is reviewed for accuracy on the hard copy. Computer data reduction requires that the analyst verify information used in final calculations is entered accurately. The analyst must also review the raw data for properly identified components, possible interferences, confirmation requirements, and acceptable readings for multiple integrations.

The analyst must verify that all data is accurately transcribed into a logbook or on a form. Organic final results are recorded on forms. Inorganic data is recorded in the logbooks. All data is manually posted in the LIMS.

Instrumentation run logs generated by the Unix/Target software for organic analysis are placed in a three ring binder which serves as the logbook for the applicable instruments. The run log identifies the file number for retrieving hard copy or electronic data. Other organic data run logs are documented in a logbook. The associated file number for retrieval of hard copy or electronic data is recorded. Additional information such as instrument ID, detector and column type, standard ID's, and other applicable information may also be recorded. Inorganic data results are entered in a logbook. The hard copy is retrievable based on the analytical date and time.

All raw data is maintained in files by the individual departments.

All associated quality control samples are documented or referenced in the logbooks along with the sample analytical data or a file number which represents the appropriate hard copy or electronic data. The recoveries are documented on the raw data or in the logbook.

Data validation is performed to check data integrity and to verify that the data is correct and of an acceptable quality. Data integrity involves reviewing all documentation for errors and mistakes. It includes review for correct documentation of sample ID's, verification that holding times were met, transcription errors, correct calculations, complete records, and for acceptable chain of custody documentation. A review of the data is performed to verify the results and to assure that all QC is within acceptable criteria. The Data is reviewed according to the criteria which applies to the particular analysis and according to the client specific project requirements. The reviewer will identify unacceptable data and initiate the appropriate corrective actions. The Department Supervisor or his representative will review the data entered into the LIMS. Validated data is released to the Report Generation Department. Hard copies of the final reports are reviewed by the Data Validation Department.

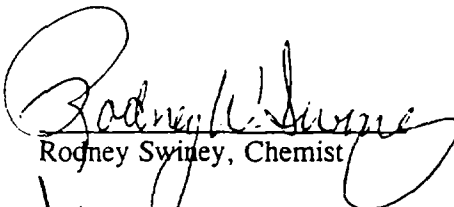
APPENDIX II

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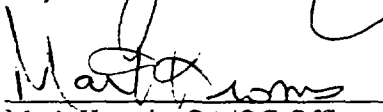
SOP No: 04	Standard Operating Procedure for the Measurement of pH in Water
SOP No: 05	Standard Operating Procedure for the Measurement of Conductivity in Water
SOP No: 06	Standard Operating Procedure for the Measurement of Temperature in Water
SOP No: 07	Standard Operating Procedure for the Measurement of Dissolved Oxygen in Water
SOP No. 10	Standard Operating Procedure for the Measurement of Turbidity

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STANDARD OPERATING PROCEDURE (SOP)
Field pH Measurement

Prepared by: 
Rodney Swiney, Chemist

Date: 9/99

Reviewed by: 
Mark Kromis, QA/QC Officer

Date: 9/99

SOP No: 04
Rev #: 00
Date: 9/99
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1.0 Scope and Application

This standard operating procedure (SOP) is applicable to the measurement of pH in drinking, surface, saline waters, domestic and industrial waste.

2.0 Summary of Method

The pH is defined as the negative logarithm of the effective hydrogen ion concentration or hydrogen ion activity in grams equivalents per liter used in expressing both acidity and alkalinity on a scale which ranges from 0 to 14 with 7 representing neutrality.

An aliquot of sample is placed into a beaker into which the pH meter probe is placed. After the temperature and pH readings have stabilized the reading is recorded into the field logbook.

3.0 Health and Safety

Safety glasses and latex gloves should be worn while the pH of the sample is being determined.

4.0 Interferences

- 4.1 Coatings of oily material or particulate matter can impair electrode response. These coating can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing.
- 4.2 Temperature effects on the electrometric measurement of pH arise from two sources. The first is caused by the change in electrode output at various temperatures. This interference can be controlled with instruments having temperature compensation or by calibrating the electrode instrument system at the temperature of the samples. The second source is the change of pH inherent in the sample at various temperatures. This error is sample dependent and cannot be controlled, it should therefore be noted by the reporting both the pH and temperature at the time of analysis.

5.0 APPARATUS

A wide variety of instruments are commercially available with various specifications and optional equipment.

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6.0 Reagents

- 6.1 Primary standard buffer salts are available from commercial vendors and should be used in situations where extreme accuracy is necessary.
- 6.2 Secondary standard buffers may be purchased from commercial vendors. Use of commercially available solutions that have been validated by to NBS standards are recommended for routine use.

7.0 Calibration

- 7.1 Due to the wide variety of pH meters and accessories, detailed operating procedures cannot be incorporated into this method. Each analyst must be acquainted with the operation of each system and familiar with all instrument functions.
- 7.2 Each instrument/electrode system must be calibrated at a minimum of two points (either 4 and 7 or 7 and 10) that bracket the expected pH of the samples and are approximately three pH units or more apart.

8.0 Procedure

- 8.1 Standardize the meter and electrode system as outlined in section 7.
- 8.2 Place the sample or buffer in a clean beaker using sufficient volume to cover the sensing elements of the electrodes and swirled in a manner to insure sufficient sample movement across the electrode sensing element as indicated by drift free (± 0.1 pH) readings.
- 8.3 If the sample temperature differs by more than 2° C from the buffer solution, the measured pH must be corrected.
- 8.4 Note and record sample pH and temperature in the field logbook.

9.0 Precision and Accuracy

- 9.1 Duplicate samples should be taken at a frequency of 10 percent and should agree within ± 0.05 pH units.
- 9.2 The pH 7 buffer should be checked after every 20 samples and should agree within ± 0.05 .

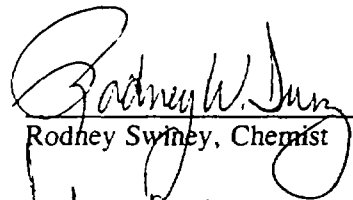
10.0 References

- 10.1 Standard Methods for the Examination of Water and Wastewater, 18th Edition.

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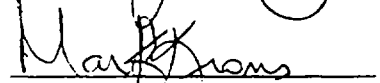
STANDARD OPERATING PROCEDURE (SOP)
Field Conductivity Measurement

Prepared by:


Rodney Swiney, Chemist

Date: 9/99

Reviewed by:


Mark Kromis, QA/QC Officer

Date: 9/99

1.0 Scope and Application

This standard operating procedure (SOP) is applicable to the measurement of conductivity in drinking, surface, saline waters, domestic and industrial waste.

2.0 Summary of Method

Conductivity is defined as the quality or power of conducting or transmitting. An aliquot of sample is placed into a beaker into which the conductivity probe is placed. After the reading has stabilized, the reading is recorded into the field logbook.

3.0 Health and Safety

Safety glasses and latex gloves should be worn while the conductivity of the sample is being determined.

4.0 Interferences

- 4.1 Coatings of oily material or particulate matter can impair cell response. These coating can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing.
- 4.2 Temperature variations and corrections represent the largest source of potential error.

5.0 APPARATUS

A wide variety of instruments are commercially available. Wheatstone bridge meters are typically used for measuring conductivity.

- 5.1 Conductivity bridge, range 1 to 1,000 μmho per centimeter.
- 5.2 Conductivity cell, cell constant 1.0 or micro dipping cell with 1.0 constant. YSI #3403 or equivalent.

6.0 Reagents

- 6.1 Standard potassium chloride solutions, 0.01M: Dissolve 0.7456 grams of pre-dried. KCl in distilled water and dilute to 1 liter at 25°C

7.0 Calibration

- 7.1 The analysts should use the standard KLC solution (6.1) and the table below to check to accuracy of the cell constant and conductivity bridge.

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Conductivity 0.01M KCl °C	Micromhos/cm
21	1305
22	1332
23	1359
24	1386
25	1413
26	1441
27	1468
28	1496

8.0 Procedure

- 8.1 Follow the direction of the manufacturer of the operation of the instrument.
- 8.2 Allow samples to come to room temperature (23 to 27 °C), if possible..
- 8.3 Determine the temperature of samples within 0.5oC. If the temperature of the samples is not 25°C, make temperature correction in accordance with the instruction in Section 9 to convert the reading to 25°.

9.0 Calculation

- 9.1 These temperature corrections are based on the standard KCl solution.
 - 9.1.1 If the temperature of the sample is below 25°C, add 2% of the reading per degree.
 - 9.1.2 If the temperature of the sample is above 25°C, subtract 2% of the reading per degree.
- 9.2 Report results as Specific Conductance, $\mu\text{mhos/cm}$ at 25°C.

10.0 Precision and Accuracy

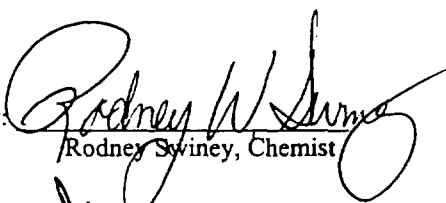
- 10.1 Duplicate samples should be taken at a frequency of 10 percent and should agree within $\pm 5\%$.
- 10.2 The KCl standard should be checked at the beginning and end of each day of use.

11.0 References

- 11.1 Standard Methods for the Examination of Water and Wastewater, 18th Edition.

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STANDARD OPERATING PROCEDURE (SOP)
Field Temperature Measurement in Water

Prepared by: 
Rodney Swiney, Chemist

Date: 1/18/2000

Reviewed by: 
Mark Kromis, QA/QC Officer

Date: 1/18/2000

SOP No : 06
Rev #: 00
Date: 1/00
Page: 2 of 3

1.0 Scope and Application

This standard operating procedure (SOP) is applicable to the measurement of temperature in drinking, surface, saline waters, domestic and industrial waste.

2.0 Summary of Method

Temperature is a measure of hotness or coldness on a defined scale.

3.0 Health and Safety

Safety glasses and latex gloves should be worn while the temperature of the sample is being determined.

4.0 Interferences

4.1 None noted.

5.0 APPARATUS

A wide variety of thermometers are commercially available. Three types of thermometers are available:

- Digital (thermo-couple) thermistor
- Glass bulb alcohol filled
- Bi-metal strip/dial indicator

6.0 Reagents

6.1 Ice water and boiling water used for calibration.

7.0 Calibration

7.1 Verify that the thermometer used has been calibrated semi annually against a National Instrument Standards and Technology (NIST) certified thermometer

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8.0 Procedure

- 8.1 Clean the probe with de-ionized water and immerse into sample
- 8.2 Suspend the sensing probe directly into the sample, or in a portion of the sample which has been collected in a small beaker. Ensure the probe does not contact anything other than the sample medium.
- 8.3 Allow the thermometer to equilibrate with the sample.
- 8.4 Record the reading in the field logbook. Report temperature readings to the nearest 0.5° C.

9.0 Precision and Accuracy

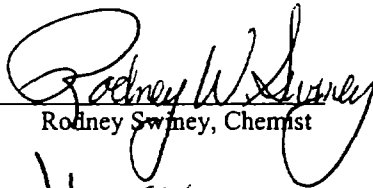
- 9.1 Duplicate samples should be taken at a frequency of 10 percent and should agree within $\pm 0.5^{\circ}$ C.

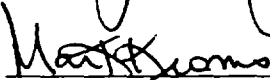
10.0 References

- 10.1 Standard Methods for the Examination of Water and Wastewater, 18th Edition.

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Rev #: 00
Date: 1/00
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STANDARD OPERATING PROCEDURE (SOP)
Field Measurement of Dissolved Oxygen

Prepared by: 
Rodney Swiney, Chemist

Reviewed by: 
Mark Kromis, QA/QC Officer

Date: 1/18/2000

Date: 1/18/2000

SOP No: 07
Rev #: 00
Date: 1/00
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1.0 Scope and Application

This standard operating procedure (SOP) is applicable to the measurement of Dissolved Oxygen (DO) in drinking, surface, saline waters, and domestic waste.

2.0 Summary of Method

This SOP describes the calibration and use of an electronic meter to measure the dissolved oxygen of surface water and other aqueous samples. The most common membrane/electrode meters for determining the DO in water are dependent upon electrochemical reactions. Under steady-state conditions, the current or potential can be correlated with DO concentrations. Interfacial dynamics at the ME/sample interface are a factor in probe response and a degree of interfacial turbulence is necessary. For precision performance, turbulence should be constant.

3.0 Health and Safety

Safety glasses and latex gloves should be worn while the DO of the sample is being determined.

4.0 Interferences

- 4.1 Dissolved inorganic salts are a factor with the performance of DO probes.
- 4.2 *Reactive gases which pass through the ME probes may interfere with the DO analysis.* For example, chlorine will depolarize the cathode and cause a high probe output. Long-term exposures to chlorine will coat the anode with the chloride of the anode metal and eventually desensitize the probe. Hydrogen sulfide will interfere with the ME probes if the applied potential is greater than the half-wave potential of the sulfide ion.
- 4.3 Dissolved oxygen ME probes are salinity temperature sensitive. The manufacturer (see manufacturers instructions) normally provides salinity and temperature compensation.

5.0 Apparatus

- 5.1 YSI Dissolved Oxygen Meter or equivalent
- 5.2 300 ml BOD bottle
- 5.3 Chemwipes
- 5.4 DO Dunker
- 5.5 Kemmerer type sampler
- 5.6 Bucket and siphon tube

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6.0 Reagents

- 6.1 KCL used as a filling solution for the DO probe.

7.0 Calibration

- 7.1 Turn the unit on.
- 7.2 Air calibrate according to the manufacturer's instructions, either in air saturated water or in a water saturated air environment.
- 7.3 The ME meter can be checked and/or calibrated against the Winkler method if desired.

8.0 Procedure

Prior to field use, the membrane of the DO meter should be inspected for air bubbles and/or holes. If air bubbles or holes exist, replace the membrane. The membrane should also be checked for dryness. If the membrane is dry, replace and soak it in analyte free water prior to calibration of the meter.

- 8.1 When possible, measure the DO in-situ with a field probe by submersing the probe in the sample. Allow the DO measurement to stabilize and then record the measurement; otherwise,
- 8.2 Collect the sample in a 300-ml BOD bottle and measure the DO with a laboratory type probe.
 - Note: Special care should be exercised to avoid entrainment of atmospheric oxygen or loss of DO. The sample should be collected with a DO Dunker (APHA-type) for depths less than five feet below water surface (BWS). A Kemmerer type sampler is recommended for depths greater than five feet BWS.
- 8.3 If an APHA-type DO Dunker is not available and a shallow depth sample is needed, a bucket may be used to collect a sample of water. A siphon tube should be coiled into the bucket such that the fill end is nearest the bottom. Using a 300-ml BOD bottle, allow the siphoning sample to fill and overflow the bottle for a minimum of three volumes.
- 8.4 If a Kemmerer sampler is used, the BOD sample bottle should be filled to overflowing by inserting the outlet tube of the sampler to the bottom of the bottle. The tube should be withdrawn slowly as the bottle is allowed to overflow three times its volume. Care must be exercised to prevent turbulence or the formation of bubbles when filling the bottle.

9.0 Precision and Accuracy

- 9.1 Duplicate samples should be taken at a frequency of 10 percent and should agree within ± 0.1 mg/l.

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10.0 References

10.1 Standard Methods for the Examination of Water and Wastewater, 18th Edition.

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STANDARD OPERATING PROCEDURE (SOP)
Field Turbidity Measurement in Water

Prepared by: Rodney Swiney
Rodney Swiney, Chemist

Date: 9/00

Reviewed by: Mark Kromis
Mark Kromis, QA/QC Officer

Date: 9/00

SOP No: 10
Rev #: 00
Date: 9/00
Page: 2 of 5

1.0 Scope and Application

This standard operating procedure (SOP) is applicable to the measurement of turbidity in groundwater and surface waters

2.0 Summary of Method

The method is based upon a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension. The higher the intensity of scattered light, the higher the turbidity.

3.0 Health and Safety

Safety glasses and latex gloves should be worn while the turbidity of the sample is being determined.

4.0 Interferences

- 4.1 The presence of floating debris and coarse sediments, which settle out rapidly, will give low readings. Finely divided air bubbles will affect the results in a positive manner.
- 4.2 The presence of true color, that is the color of water which is due to dissolved substances which absorb light, will cause turbidities to be low, although this effect is generally not significant with finished waters.

5.0 Apparatus

- 5.1 The turbidimeter shall consist of a nephelometer with light source for illuminating the sample and one or more photo-electric detectors with a readout device to indicate the intensity of light scattered at right angles to the path of the incident light.

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The turbidimeter should be so designed that little stray light reaches the detector in the absence of turbidity and should be free from significant drift after a short warm-up period

- 5.2 The sensitivity of the instrument should permit detection of a turbidity difference of 0.02 unit or less in waters having turbidities less than 1 unit. The instrument should measure from 0 to 40 units of turbidity. Several ranges will be necessary to obtain both adequate coverage and sufficient sensitivity for low turbidities.
- 5.3 The sample tubes to be used with the available instrument must be clear, colorless Glass. They should be kept scrupulously clean, both inside and out, and discarded when they become scratched or etched. They must not be handled at all where the light strikes them, but should be provided with sufficient extra length, or with a protective case, so that they may be handled.
- 5.4 To minimize differences in the physical design of turbidity meters, the following design criteria should be observed:
 - 5.4.1 Light source: Tungsten lamp operated at a color temperature between 2200-3000°K .
 - 5.4.2 The distance traversed by incident light and scattered light within the sample tube should not exceed 10 cm.
 - 5.4.3 Detector: Centered at 90° to the incident light path and not to exceed $\pm 30^\circ$ from 90°. The detector, and filter system if used, shall have a spectral peak response between 400 and 600nm.

6.0 Reagents

- 6.1 Turbidity-free water: Pass distilled water through a 0.45 μ pore size membrane filter if such filtered water shows a lower turbidity than the distilled water.
- 6.2 Stock formazin turbidity suspension: Can be ordered from HACH

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7.0 Calibration

- 7.1 Turn the meter "ON".
- 7.2 Rinse the sample cell 3 times with organic free or deionized water.
- 7.3 Fill the cell to the fill line with organic free or deionized water and then cap the cell.
- 7.4 Use a non-abrasive lint-free paper or cloth (preferably lens paper) to wipe off excess water and streaks.
- 7.5 Open the cover and insert the cell (arrow to the front) into the unit and close the cover.
- 7.6 Press "READ" and wait for the 'light bulb' icon to go off. Record the reading.
- 7.7 Using the Gelex standards, repeat steps 7.4, 7.5, and 7.6. Record all findings (note anomalies).

8.0 Procedure

- 8.1 Collect a specific sample or use a portion of the sample that is collected for pH, temperature, or conductivity analysis, and pour off enough to fill the cell to the fill line (approximately $\frac{3}{4}$ full) and replace the cap on the cell.
- 8.2 Wipe off excess water and any streaks with non-abrasive lint-free paper or cloth (lens paper).
- 8.3 Place the cell in chamber of the 2100P with the arrow towards the front and close the cover.
- 8.4 Press "READ" and wait for the 'light bulb' icon to go off. Record the reading.
- 8.5 Rinse the cell with organic-free or analyte-free water.

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8.6 For the next sample, repeat Steps 8.1-8.5.

9.0 Precision and Accuracy

9.1 In a single laboratory (EMSL), using surface water samples at levels of 26, 41, 75, and 180 NTU, the standard deviations were ± 0.60 , ± 0.94 , ± 1.2 , and ± 4.7 units, respectively.

10.0 References

10.1 Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 2130B.

APPENDIX III

SKINNER LANDFILL EFFLUENT DISCHARGE REQUIREMENTS

Effluent parameters for discharge to the sanitary sewer have not yet been established by the Butler County Department of Environmental Services (BCDES). When BCDES does issue an authorization to discharge, the discharge requirements will be inserted into this Appendix.

APPENDIX IV

STANDARD OPERATING PROCEDURES
FOR EFFLUENT PARAMETERS

Effluent parameters for discharge to the sanitary sewer have not yet been established by the Butler County Department of Environmental Services (BCDES). When BCDES does issue an authorization to discharge, the applicable standard operating procedures will be inserted into this Appendix.